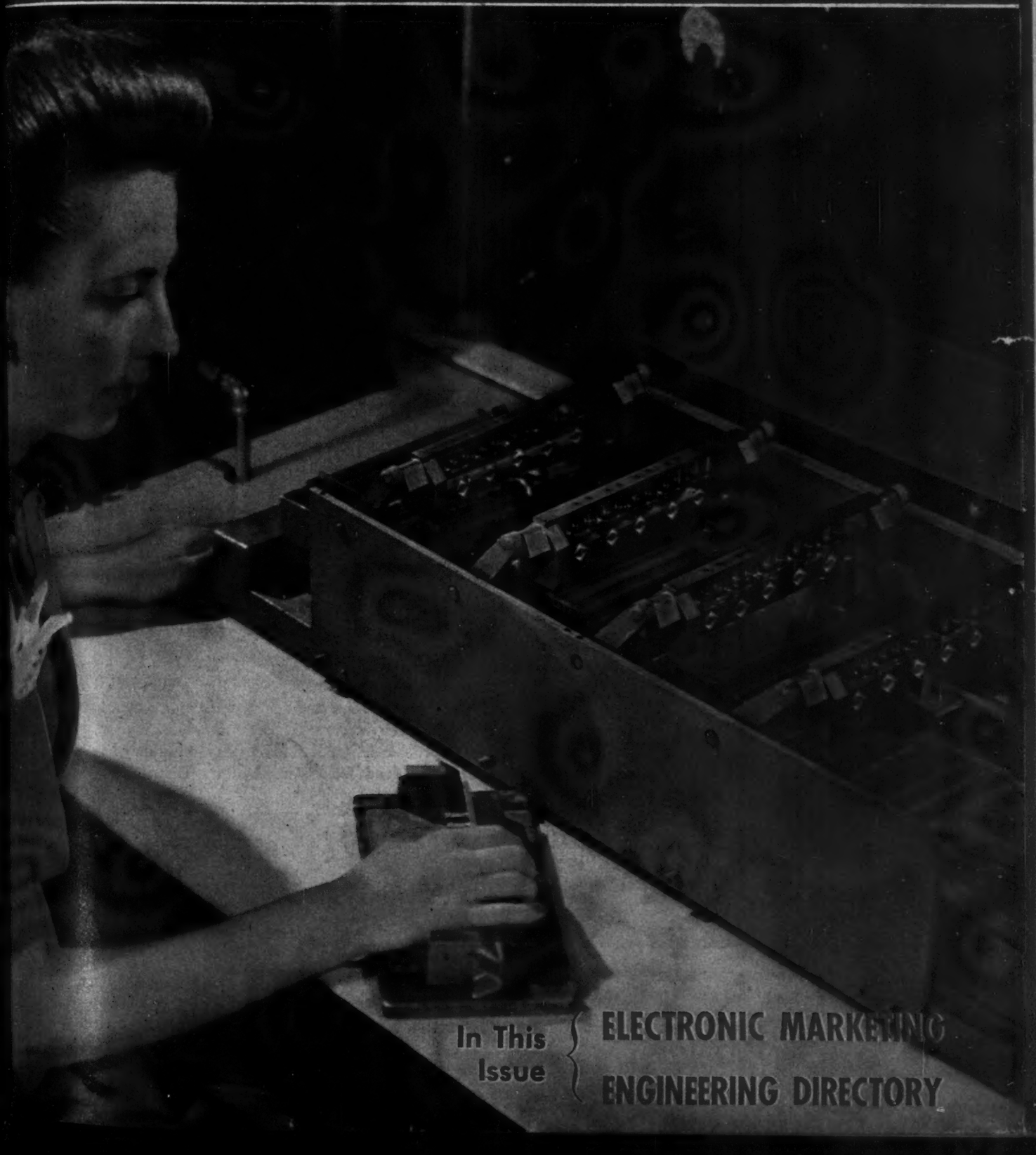
ELECTRONIC INDUSTRIES

CALDWELL-CLEMENTS, INC. ★ MAY 1946



In This Issue { ELECTRONIC MARKETING
ENGINEERING DIRECTORY

Great Little Space-Saver

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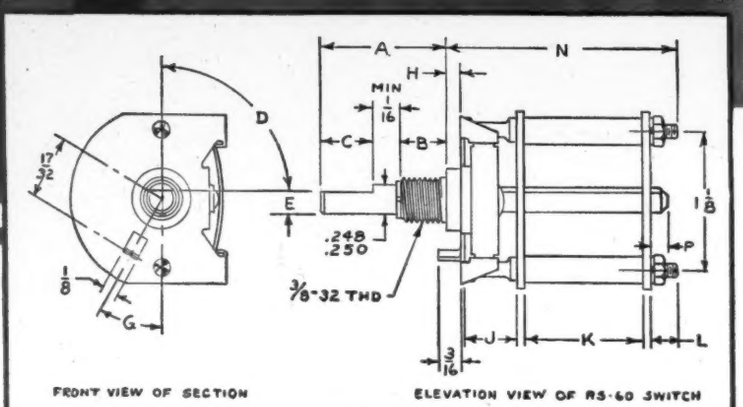

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ELECTRONIC INDUSTRIES

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★ IN THIS ISSUE MAY, 1946 ★

FRONT COVER—Crystal Plating Process ..... See page 4
EDITORIAL 61
TELE-GUIDED MISSILS 62
ENGINEERS STUDY FM
Broadcasting Engineering Conference 66
INSTRUMENTATION 71
PRODUCTION BRIDGE FOR INCREMENTAL TESTS—Werner Muller 72
COAXIAL FEED FM LOOP ANTENNAS—A. G. Kandoian 74
COIL SHORT TESTS—Norman L. Chalfin 77
TUBES ON THE JOB 78

ELECTRONIC MERCHANDISING

CULTIVATE EXPORTS!—H. Gregory Shea 80
MARKETING—Now the Twin Problem With PRODUCTION—M. H. Newton ... 82
WHAT'S NEW—CHICAGO 84
RADIO STATIONS 89
SET MANUFACTURERS 93
SHOW EXHIBITORS 95

1946 ELECTRONIC ENGINEERING DIRECTORY ..... opposite 96
TV RECONNAISSANCE 96
SURVEY OF WIDE READING D-48
NEW PATENTS ISSUED 102

News of Industry 98
Washington News 100
Television Today 104
Personnel 144
New Bulletins 156
New Books Reviewed 162
What's New 106, 108, 110, 112

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CALDWELL-CLEMENTS, INC. — TEL. PLAZA 3-1340 — 480 LEXINGTON AVENUE, NEW YORK 17, N. Y.

Electronic Industries*, May, 1946. Vol. V, No. 5. Regular price per copy 35 cents. Published monthly by Caldwell-Clements, Inc., 480 Lexington Avenue, New York 17, N. Y. M. Clements, President; Orestes H. Caldwell, Treasurer. Subscription: United States and possessions, Mexico, Central and South American countries, $3.00 for one year; $5.00 for two years; $6.50 for three years. Canada, $3.50 per year; $5.50 for two years; $7.15 for three years. All other countries $5.00 a year. Entered as Second Class Matter, September 20, 1943, at the Post Office at New York, N. Y., under the act of March 3, 1879.

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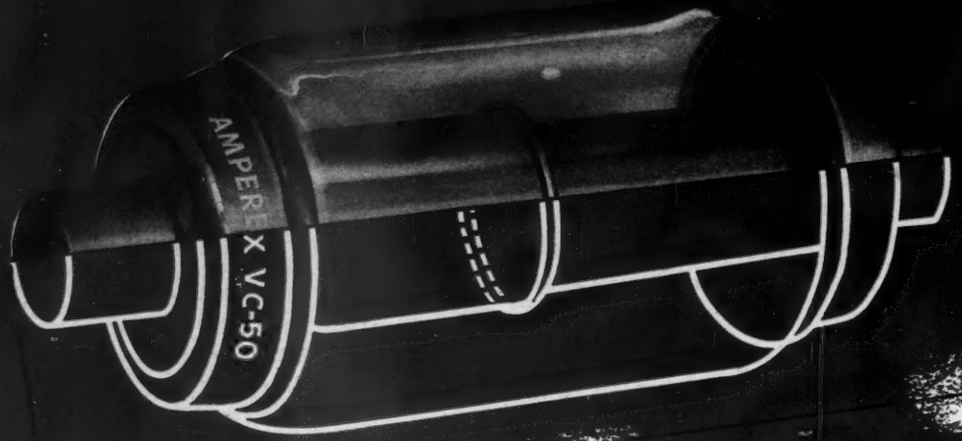
New Vacuum Co... Cuts Frequency...



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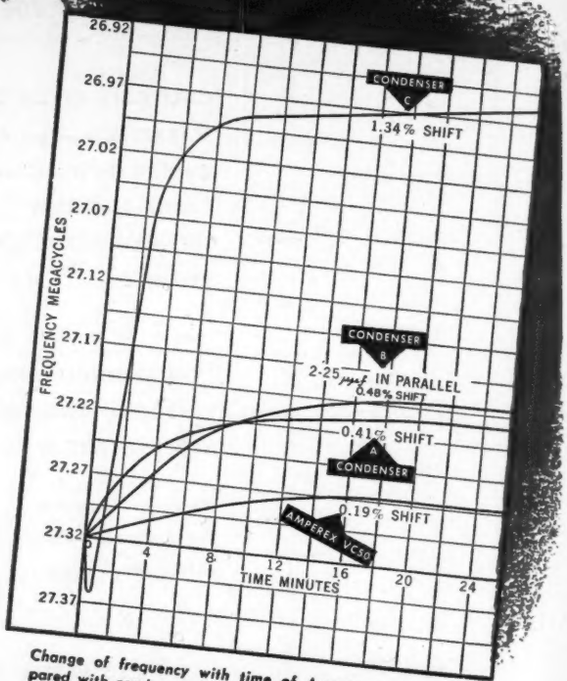

Change of frequency with time of Amperex VC50 compared with condensers of three other leading manufacturers in a typical piece of industrial equipment operating at 27.32 MC with a 50 uuf vacuum tank condenser and 2000 V.D.C. plate supply under no-load conditions.

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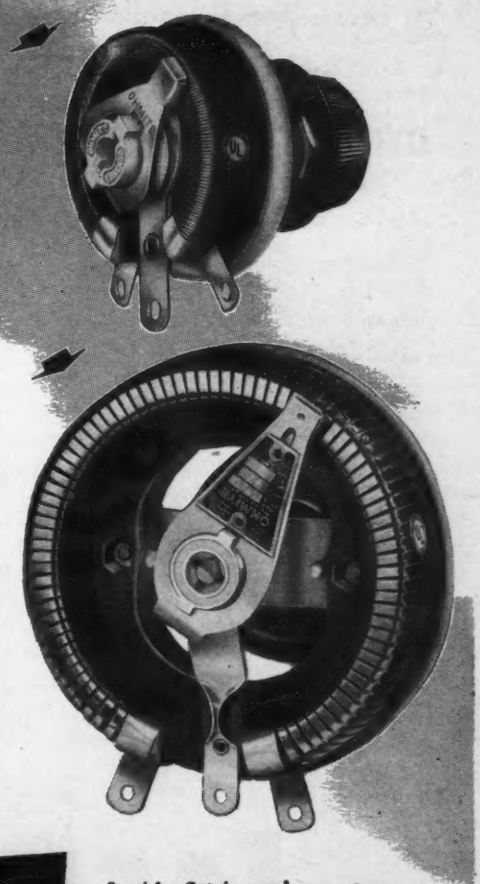
VISIT BOOTH NO. 72 AT THE RADIO PARTS AND ELECTRONIC EQUIPMENT CONFERENCE AND SHOW HOTEL STEVENS, CHICAGO, MAY 13-16



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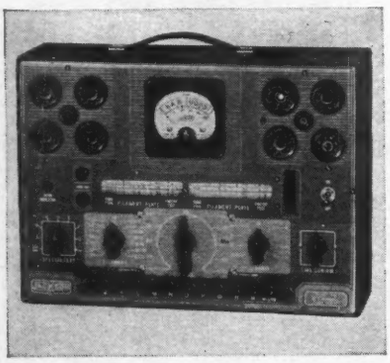

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THE COVER

A plating process for quartz crystals, developed by Bell Telephone Laboratories and used by the Western Electric Co. in the manufacture of millions of crystal units for the Armed Forces, was probably one of the most outstanding contributions towards mass producing delicate crystal plates during war years.

Prior to the introduction of the plating process, the crystal wafers were hand lapped to exact frequency after the machining operation in order to meet extreme tolerances. By the application of the new process, hand lapping was eliminated. In the process devised, a gold solution was applied and fired, resulting in a base deposit of pure gold on the faces of the crystal wafer to provide a conducting surface. The frequency of this gold plated crystal was measured and the difference from the desired frequency determined. The crystal was then placed in an electroplating bath for a period of time long enough to deposit sufficient nickel on the gold to obtain the desired frequency.

GE College Issues Sheepskins

General Electric Co., which for a period of twelve weeks last fall operated a "college of Industrial Electronics", has issued sheepskins to those who completed the course. Certificates attest that the student "having diligently attended General Electric's special Industrial Electronics Training Course for editors and other vendors of the printed word is presumed to have gained sufficient knowledge of Industrial Electronics to be equipped to lecture on electronic subjects to all Thursday noon luncheon clubs, syndicate a column in all newspapers with circulations greater than 8,000,000 blue pencil recklessly all copy on the subject or otherwise question the authenticity of all statements on matters electronic made by other than classmates or members of the faculty. Moreover the recipient is henceforth to be recognized as a possessor of the degree hereby conferred, Profound Harbinger of an Electronic World, and is entitled to affix to all future bylines the letters PHEW. In witness, thereof, we have this day set our hand and seal—L. A. Umansky (Dean), J. L. Diefenderfer (Co-Chairman), A. H. Moore (Co-Chairman), C. P. Fisher, Jr. (Secretary of Admissions)".

ELECTRONIC INDUSTRIES

Including INDUSTRIAL ELECTRONICS

O. H. CALDWELL, EDITOR ★ M. CLEMENTS, PUBLISHER ★ 480 LEXINGTON AVE., NEW YORK (17), N. Y.

Electronic Markets

Thorough-going engineers do not always take kindly to the commercial aspects of their profession. Preferring to steep themselves in purely technical matters, the younger men, particularly decry business inroads on their attention and thinking. Marketing, they complain, is bothersome business, of no concern to specialists in enginering techniques and theory.

More mature engineers, however, recognize that commercial subjects eventually parallel technical matters in the development of any personal career.

Markets Underlie All

For no engineer's job or paycheck is secure unless there is a market for his services and for the output of his firm. Markets and sales form the foundation for practically all engineering activities.

That is why this Electronic Marketing issue of Electronic Industries can be of prime usefulness to every reader, however erudite. New markets point the way to new engineering opportunities. Expanding markets are necessary to stabilize existing engineering operations.

The Pioneer Spirit

Radio men from the beginning have been pioneers. Always the spirit of radio has been to replace existing methods with something better. In this adventuring mood the radio industry has continuously produced new ideas—and a wake of obsolescence.

But now that radio has gotten rich in dollars, care must be taken lest we become conservative and fearful of new exploits. The youths who pioneered so much for radio in the 1920's are now passing middle age, prosperous beyond their early dreams. With bulging midriffs (both abdominal and mental) they now too often think of conserving and holding—rather than hazarding and exploring further into radio's vast new possibilities.

Radio's boundaries are still endless. Some of the old pioneers are still leading in the new adventuring of '46 and '47. But the whole industry needs to keep on pioneering. Radio and the world will lose much if the pioneer spirit is ever abandoned by those once-adventurers who can now afford the ease of prosperity!

Local Co-operation Between Engineers

More U. S. cities are now laying plans for close co-operation between local sections of the principal national enginering societies. Advantages of the plan are joint meeting notices, an established central office and meeting place, and better understanding by each group of engineers of the other groups. The mechanics of such hometown co-operation can be handled without sacrificing the independence of the individual sections.

Electronic engineers have most to gain from such local co-operation. For electronic applications now permeate all engineering. And the electronic men in any community should be well acquainted with all their fellow-citizens who are solving problems of any kind on the broad front of engineering.

Radio on the Highways

One of the companies which is very active in the point-to-point communication field tells us that automobile fleets of all kinds are enthusiastic about radio control routing. This is being adapted not only to taxicabs but also to public utility fleets and others who find constant communication an extraordinary advantage. Costs are about $1,000 for a sending station and a few hundred dollars for equipping individual cars. This looks like the beginning of a big new industry.

In this connection a number of leading engineers have been down in Washington helping the Federal Communications Commission get a workable allocation scheme for the 160 mc point-to-point communication band. The 40-kc cleared channels originally provided for in this band are not sufficiently wide and it is found that only alternate channels can be used.

Electronic Marketing Features in this Issue—

	Page
Export Opportunities for Radio	80
Electronic Markets and Expanding Sales	82
New Products Shown at Chicago	84
Broadcast Stations, AM, FM and TV, with Chief Engineers	89
Receiver Manufacturers, with Chief Engineers and Purchasing Agents	93
Chicago Radio Show Exhibitors and Exhibits, May 13-16	95
Electronic Engineering Directory	facing 96

TELE-GUIDED MISSILS

Remote control of bombs made possible by development of midget television transmitter carried by the bomb itself

• For the accurate control of missils in flight, successful guidance to the most effective location long has been obtained only by the control of elevation, direction and speed, as based on information available at the time the missile was launched. The more accurate this information is, the more effective is destruction by the missils. All guiding information must be collected, considered and utilized before the projectile leaves the control of the operator, and no correction because of circumstances encountered during flight can be made after it is launched. Subsequent action of the target can be anticipated (if it is visible or if it is within the operating range of Radar) and utilized only if radio controlled guidance is available.

It has long been the dream of members of the ordnance department to provide some sort of gadget that would transmit back to the operator information encountered by the missile during flight, so that he could make efficient use of the methods of radio control which have long been known. In order to utilize the advantages of radio control, it is necessary that the operator keep informed both as to the conditions at the target and those at the missile itself.

Inasmuch as the life of a human operator was never considered expendable here as it was, for example, in the case of the one-man operated torpedoes of the Japanese, much thought has been given to the possibility of having the missile send back useful information to the control operator. As a result, many successful remote controlled bombs incorporating complete television camera equipment of a "midget" type have been developed, tested and found of value.

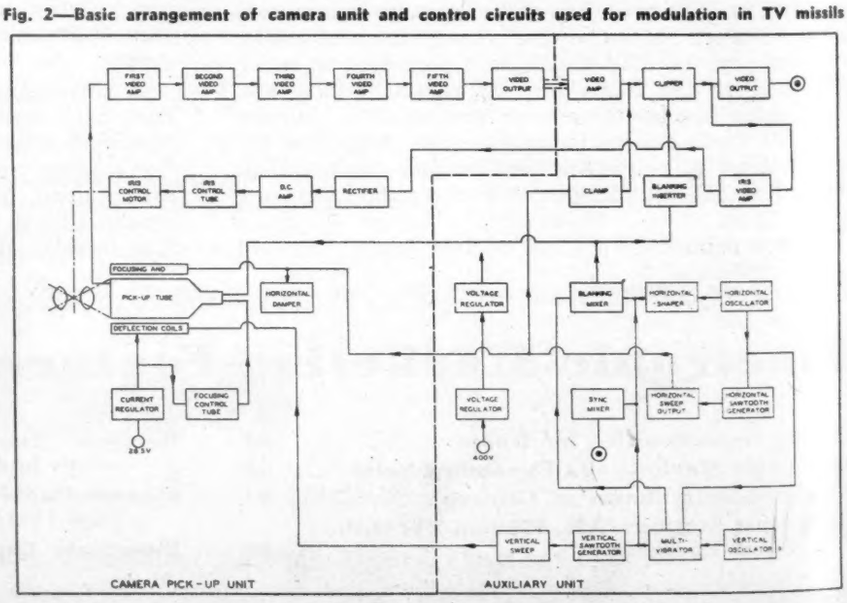
Many types of missils were considered in this remote-control project and before the recent end of fighting, a great deal of practical experience was gained in television-equipped units ranging from glider bombs (bombs equipped with small lifting wings) to complete television-equipped unmanned planes. These units contain all the necessary equipment for looking ahead along the line of travel, picking up the scene with a special camera pick-up tube and transmitting the picture back in ordinary television style to the control operator at a land base or on a plane.

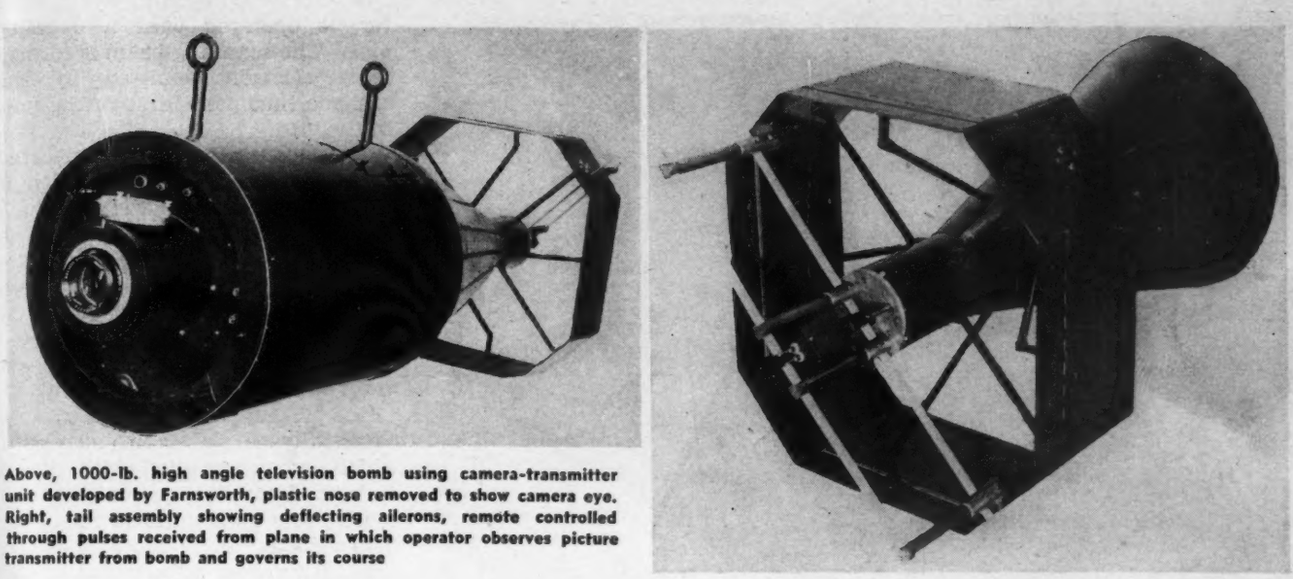
Fig. 1—Left to right, these Remington-Rand ordnance television experts are: Vacuum tube section chief engineer M. P. Wilder; Electronics division chief engineer James J. Lamb; Equipment section chief engineer J. A. Brustman; special projects engineer P. S. Rand. USNR officer is Com. T. W. Chew. Lamb holds "small package" camera-auxiliary unit, other equipment being interchangeable Image Vericon and standard Vericon cameras, the 780-900 mc transmitter and regulated supply

A description of the lightweight "eye" that was developed from this intensive research by the Electronic Division of Remington-Rand (Middletown, Conn.) will show the progress made on the problem which will have a bearing on not only commercial uses of television, but on industrial uses as well. Here the camera head and its associated control unit form a complete television picture pick-up system designed to deliver video, blanking, and synchronizing signals of the proper amplitudes and characteristics to modulate a radio-frequency transmitter. The units associated with these small "package" television systems are shown in Fig. 1.

A block diagram of the two units, showing the various circuit func-

Fig. 2—Basic arrangement of camera unit and control circuits used for modulation in TV missils





Above, 1000-lb. high angle television bomb using camera-transmitter unit developed by Farnsworth, plastic nose removed to show camera eye. Right, tail assembly showing deflecting ailerons, remote controlled through pulses received from plane in which operator observes picture transmitter from bomb and governs its course

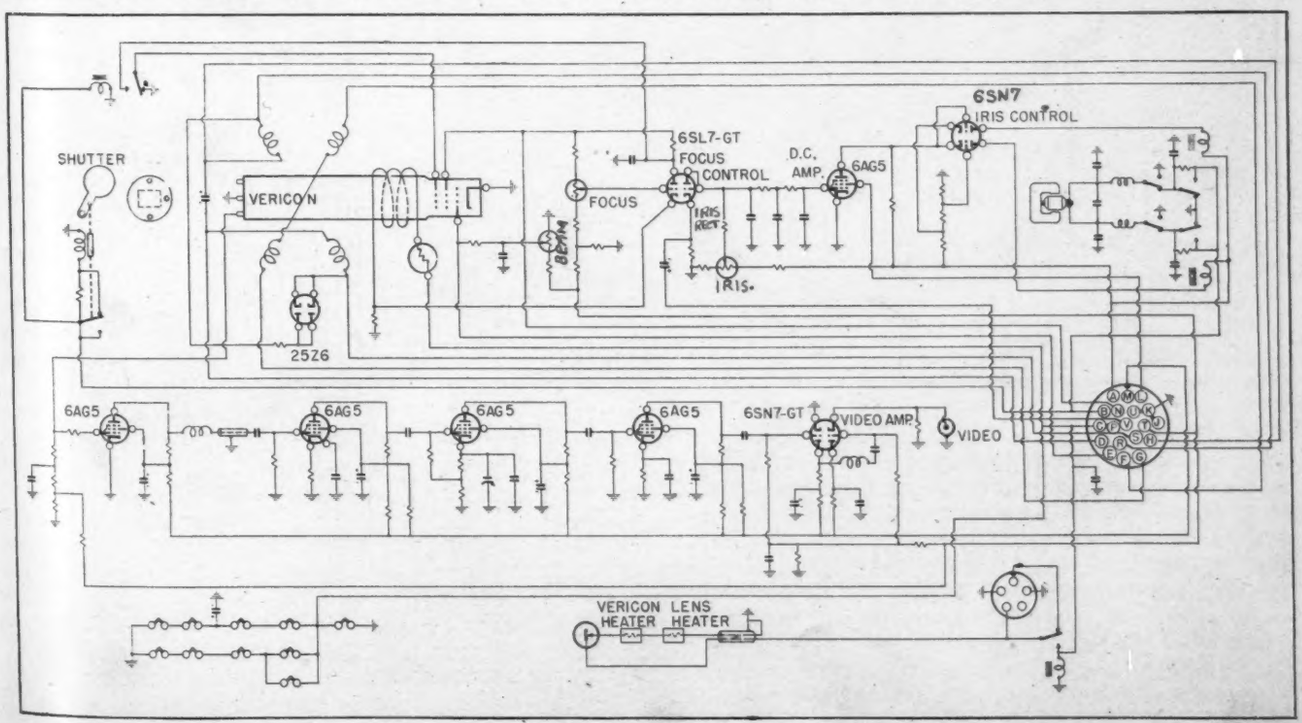
tions, is given in Fig. 2. In general, each block shown here involves the use of one set of vacuum-tube elements, although double - triode tubes are used wherever possible.

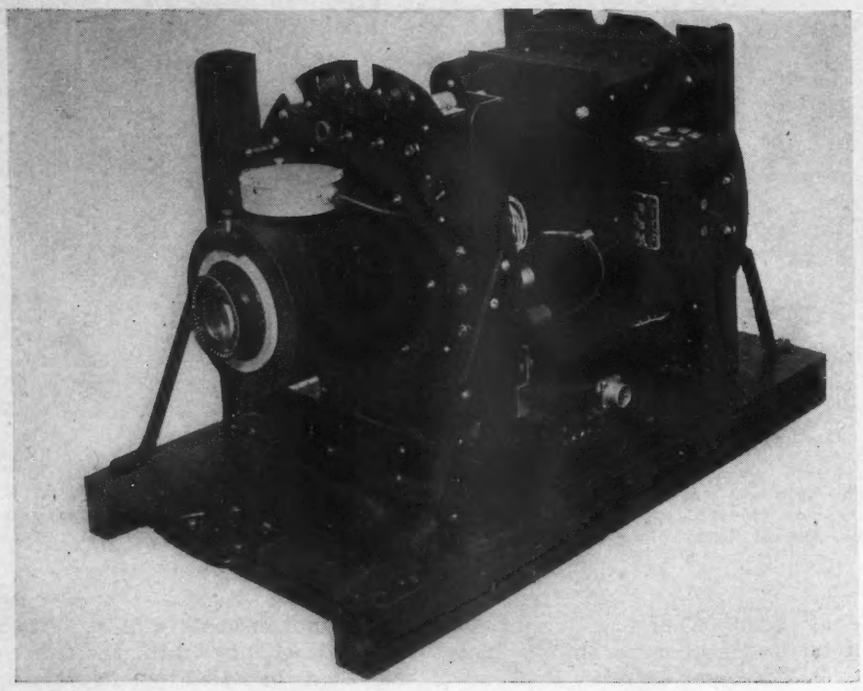
Vertical scanning of the pick-up tube mosaic is at the rate of 40 per second and horizontal scanning at the rate of 14,000 per second, giving a 40-frame, nominal 350-line picture. The actual number of lines in the picture is between 325 and 330, the remaining lines being cut off during the vertical blanking period. Resolution in the horizontal direction is at least 300 lines in the center area of the picture, and at least 250 lines in the corners. A system of this type must operate unattended. Therefore, many unusual and automatic circuits had to be developed to make this possible.

A functional drawing of the pick-up tube, a "Vericon" and its associated focusing and deflecting equipment is given in Fig. 3A. The tube is of the low-velocity scanning beam type, consisting essentially of a cylindrical glass envelope with an electron gun at one end and a photo-sensitive signal plate assembly at the other as in Fig. 4. The signal-plate assembly consists of a thin sheet of clear mica coated on one side with a transparent but continuous film of metal (the signal plate) and on the other side by the photo-sensitive mosaic. The mosaic is 0.825 by 1.1 in., the entire area being occupied by microscopic photo-emissive dots or "islands," each insulated from the others by the mica support. Each small area is a conductive surface and together with the metallic coating on the opposite side of the mica sheet forms a tiny capacitor.

Each of these capacitors, of which there are millions, becomes electrically charged by the action of light, by reason of the emission of photo - electrons when light strikes the islands. The signal-plate assembly is mounted with the continuous metal film facing the end of the tube.. This film is thin

Fig. 3—Schematic of Vericon pickup tube and associated circuits. In another type of pickup camera the more sensitive Image Vericon tube is used





Complete assembly of the Farnsworth camera-transmitter unit for tests of 1000-lb. high angle television controlled bomb

enough so that it is essentially transparent. The image of the scene to be televised is focused on the mosaic by the optical lens system through the end of the tube, the metal film, and the mica sheet.

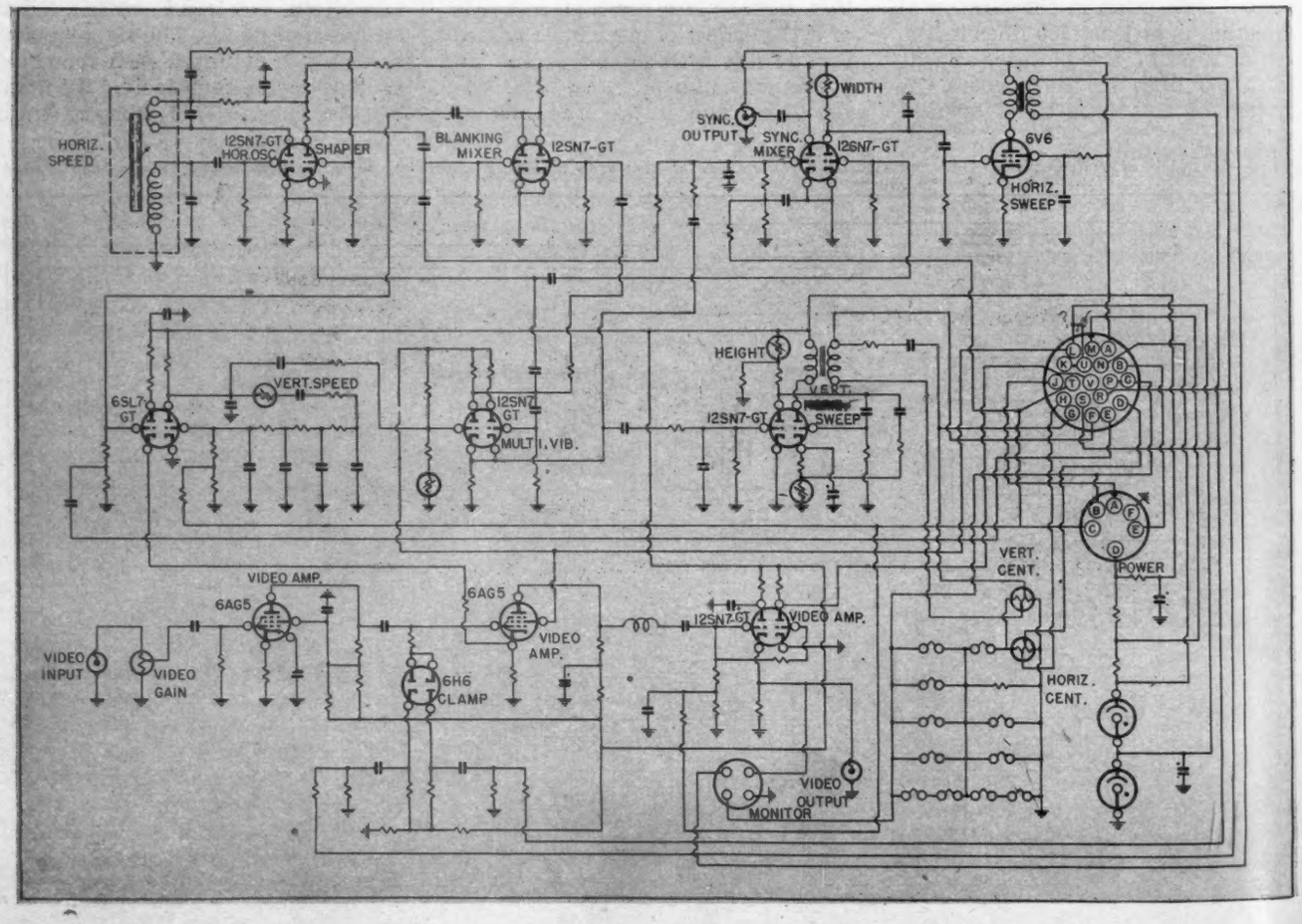
The electron gun is essentially the same as in any cathode ray tube. The control grid G_1, a metal disc with a small hole at its center, is operated with a negative bias. The scanning beam is formed from electrons emitted by the cathode that pass through the hole in the grid.

The electron beam is accelerated by the second grid (G_2), which is operated at approximately 250 volts positive with respect to the cathode. The G_2 electrode resembles G_1 in that it is a metal disc having a center hole, but the hole in the G_2 electrode is made much smaller—approximately 0.002 in. square—in order to confine the beam diameter.

The pick-up tube is mounted concentrically in a multi-turn coil which, when supplied with direct current from the primary power source, sets up a uniform magnetic field directed along the axis of the tube. By proper adjustment of the current in the coil and the voltage on the anode the beam can be brought to focus at the surface of the mosaic.

It is the function of the electron beam to discharge the small charges appearing on the elements on the mosaic that result from light falling on them. If the beam were allowed to travel to the mosaic at the velocity given it by the electron gun, the impact of the elec-

Fig. 6—Scanning circuits and video control circuits of Remington-Rand equipment. Separate synchronizing and video modulation signals feed to the transmitter, the former plate-modulating the transmitter and the video signal modulating the grid



trons on the mosaic would, however, knock out secondary electrons in the ratio of several secondaries for each impinging primary electron. These secondary electrons in the region of the mosaic would cause a space charge distribution which would result in spurious signals, giving rise to "shading" difficulties.

To prevent this, a ring-shaped metallic electrode is plated on the inner wall of the envelope near the mosaic. This electrode is operated at cathode potential and is therefore negative with respect to the anode by the amount of the anode voltage. Thus the beam must pass through a retarding field. The retardation is such that the beam approaches the mosaic at substantially zero velocity, with the result that secondary emission is negligible and the tube is free from spurious signals.

The electron beam is deflected horizontally and vertically by magnetic fields set up by currents flowing in deflection coils mounted between the tube and the focusing coil. The fields of these deflection coils are at right angles to each other and to the focusing field, so that the resultant field, when currents are flowing in all three circuits, directs the beam to a spot on the mosaic determined by the resultant field strength.

As a result of the electron emission, each elementary capacitor of the mosaic acquires a charge, the quantity of which is proportional to the impinging light.

The mosaic elements continue to charge until discharged by the scanning beam (once each 1/40th second). As the scanning beam moves across the mosaic it restores the missing electrons to each charged element, the positive charge on the mosaic element being sufficient to attract the necessary number of electrons from the beam. However, since the beam velocity at the mosaic is zero, without such attraction more than the proper number of electrons cannot be deposited on the island. The movement of the excess electrons in the beam reverses and they go back down the tube, where they are collected.

The video output is pulsating current as the elemental mosaic islands are discharged in turn. Flowing through the load resistor, it develops a signal voltage. The subsequent handling of this signal is shown in the circuit diagrams Figs. 3 and 6.

In view of the small area of the mosaic it is necessary that an extremely sharp focus be maintained. If for some reason either the focusing coil current or the anode voltage (or both) change, the sharpness of the focus may be adversely affected. Both coil current and anode voltage depend upon the primary supply voltage, which can be expected to vary during operation. Focus also will be dependent upon temperature, since the resistance of the focusing coil will change with temperature and the current through the coil consequently will change, even though the primary supply voltage is constant.

To overcome these effects in so far as possible, the anode supply

(*Continued on page* 114)

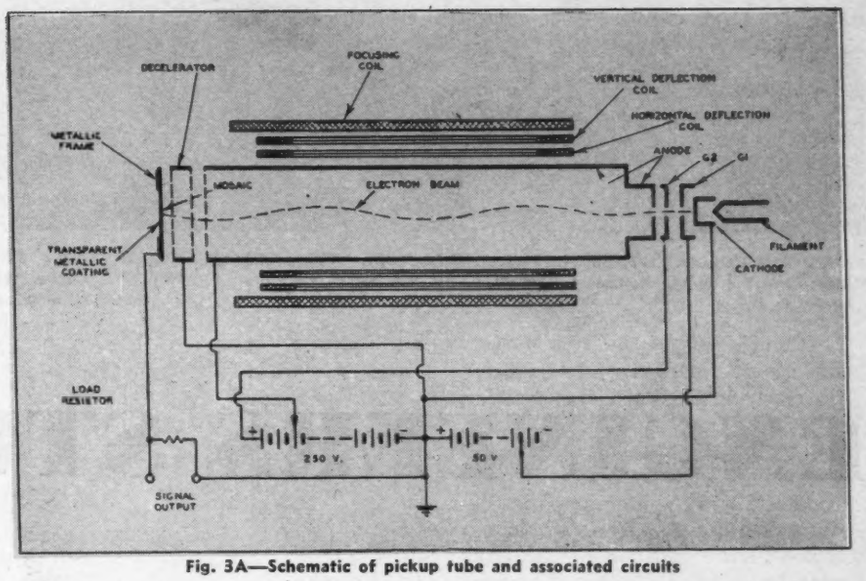


Fig. 3A—Schematic of pickup tube and associated circuits

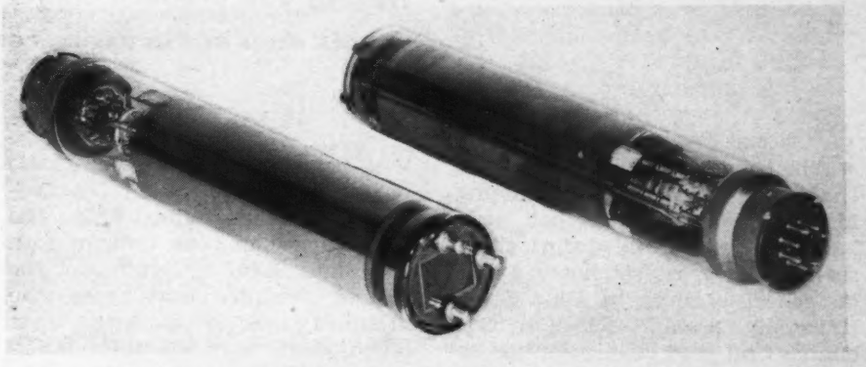


Fig. 4—Two views of the standard Vericon tube used in guided missile cameras

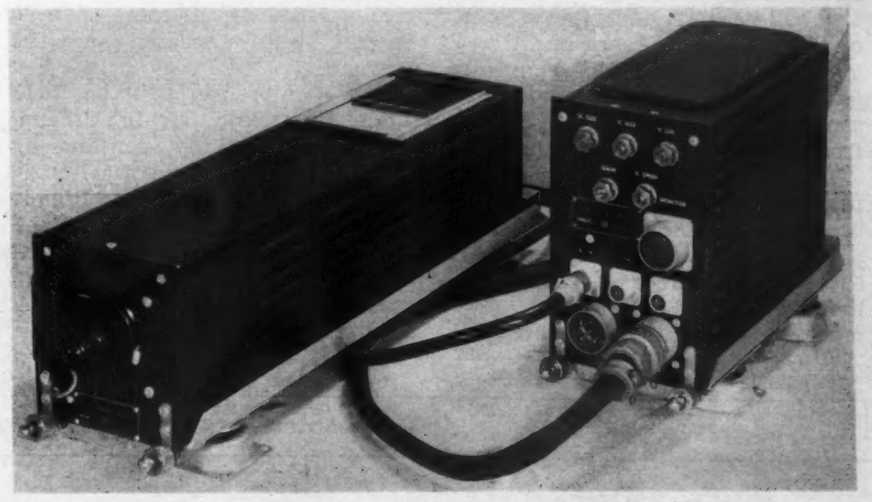


Fig. 8—All units of the system are shock mounted to reduce vibration modulation. Controls on the pickup camera are reached through a sliding panel. At right is the auxiliary control unit of the AN/AXT-6 airborne television unit

PANEL ON FM OPERATING TECHNICS—J. A. Waldschmitt, (WOR); Paul Dillon (WMIT); Phillip B. Laeser (WTMJ); Carl Wesser; D. C. Ports (Jansky & Bailey)

ROUND TABLE SYMPOSIUM EXPERTS—D. W. Gellerup (WTMJ); Howard S. Frazier (NAB); Dr. John A. Willoughby (FCC); E. W. Allen, Jr. (FCC); R. Morris Pierce (WGAR)

ENGINEERS STUDY FM

Nearly 400 broadcasting technicians gather in Columbus for six days of discussions on practical operating problems

• The thinking was hard. So were the seats. For six days, starting March 18, broadcasters had gone back to school. And during those six days they sat six hours a day on school benches in Ohio State University's Campbell Hall in Columbus and paid close attention to proceedings of the Sixth Annual Broadcasting Conference. The affair had been revived after a lapse of the several war years, and it attracted just under 400 engineers from all over the United States, some from Canada and at least one from as far away as Honolulu.

These engineers were interested primarily in the practical side of broadcast engineering. There was a relatively small amount of pure theory on the program. After all, it was the ordinary, every day, practical problems having to do with station, transmitter and studio operation around which the program had been built. When the conference had been brought to a close late Saturday afternoon, the feeling prevailed that those who attended took away with them much good, workable information as a result of the practical data with which sessions had been liberally larded by the more than 50 experts who appeared on the rostrum.

The Conference will be held again next year but in Urbana, Illinois, being jointly sponsored by the departments of electrical engineering of the University of Illinois and Ohio State University with the cooperation of the National Association of Broadcasters and the Institute of Radio Engineers. A feature of the gathering was an exhibition of transmitting, measuring, monitoring and allied equipment participated in by ten manufacturers. Dr. W. L. Everitt, past president of IRE and head of Illinois University's electrical engineering department, was director of the conference.

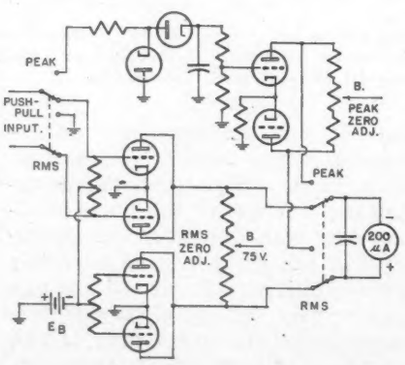
As might have been expected, interest centered largely on FM. Eight of the seventeen sessions had to do almost entirely with broadcasting's baby. But though considerable time was devoted to engineering matters, ranging as talks did from theory to technical descriptions of commercial products, engineers appeared most interested in interpretations of FCC rulings, the current thinking of FCC personnel as far as concerns operating technics and the effect of rulings and regulations on FM stations.

Briefing the Broadcast Conference Papers

ANTENNA PATTERNS

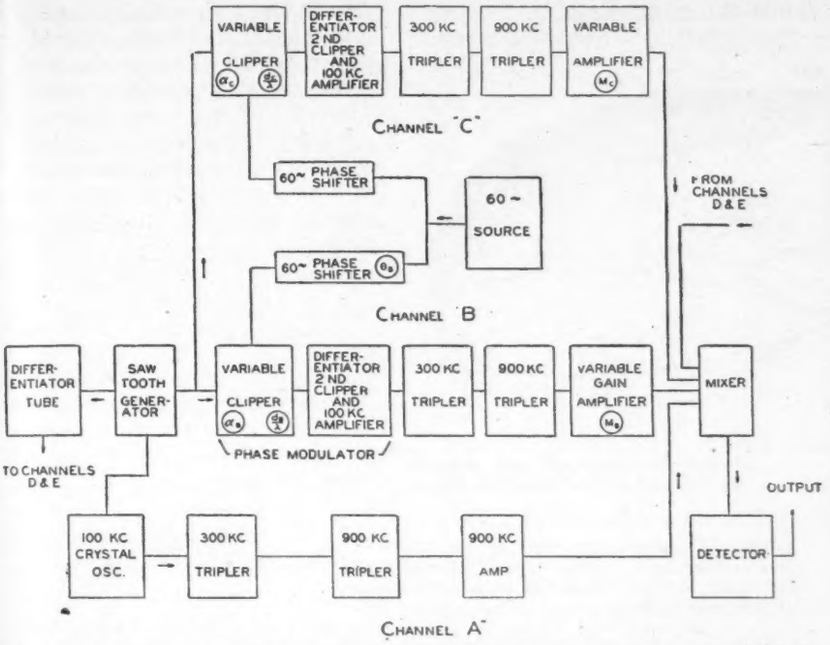
The antennalyzer is an electronic calculator that delineates the solution (visually on a cathode ray tube) of multiple antenna arrays by utilizing analogous relations between operating parameters associated with antennas and the phase modulation of certain sine wave potentials. It was described in considerable detail by Dr. George H. Brown, and demonstrated by W. C. Morrison, both of RCA.

While the instrument can be utilized to delineate in either polar or rectangular coordinates the pattern of a given array, its greatest usefulness is to show what pattern changes result in an improvement when the phase angle and the currents to each element are altered. It also can be worked backward, since desired patterns plotted on a map can be matched in short order by watching the pattern shifts as



With the Antennalyzer visual indication of pattern of array can be supplemented by voltage measurements giving either peak or RMS values, using this circuit

several parameters are altered. As soon as a pattern is approximated that gives the desired protection in one or more directions, the physical layout of the array that would give



Block diagram of the Antennalyzer. Channels D and E, not shown, are similar to Channels B and C. Output is fed to an RCA type 327-A oscilloscope which is used as an indicator

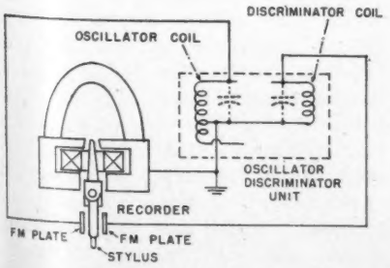
those results is read off the control dials.

The antennalyzer was demonstrated with the solution of several array problems, and will be made available by the RCA at Camden as a service to broadcasters who encounter difficult coverage problems in their territory.

RECORDING TECHNICS

The first portion of this discussion by H. R. Roys (RCA) was devoted to disc recording problems. The non-dependence of the cutting speed on the cutting force was shown. Curves also were shown relative to the cutting force requirements with groove width.

A frequency modulation type of



H. R. Roys explained how measurement of amplitude excursions of any pick-up are made by applying capacitor elements near needle to frequency modulate a local oscillator

calibrator that is useful in measuring the amplitude of stylus motion was illustrated and involved two small capacitor plates mounted near the stylus arm (which is grounded). The capacitance variation in one direction shifts the frequency of an oscillator, while the capacitance variation from the opposite plate alters the resonance conditions in a discriminator circuit operating from the oscillator output. In this way stylus travel amplitude is determined from a record of the output to the discriminator load circuit.

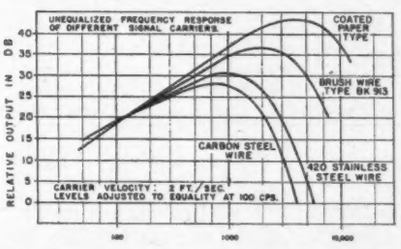


Chart showing frequency response of coated paper tape and various types of wire as used in the Brush recorder-reproducers

It was shown that the most important factor in recording fidelity was intermodulation and circuits were described for measuring this effect.

A historical presentation of the art of magnetic recording was given by Dr. S. J. Begun (Brush Development Corp.) and was followed by details of two high fidelity systems using (1) magnetic tape prepared by coating a paper ribbon with a magnetic powder having a high coercive force, and (2) a ductile brass wire plated with .0003 in. coating of nickel cobalt material.

This paper contained a plea for more action in standardizing recording methods, such as the selection of a definite groove contour shape, and the shape of the stylii. Several conditions were noted where non-conformity resulted in large distortion factors.

A statement relating to the ultimate use of magnetic recording methods in the future, particularly for broadcasting work, mentioned certain disadvantages at present which require careful consideration before this method can be universally accepted. These included the need not only for constant speed but for accurate speed within 0.2% so that the timing of a recording can be correlated with the split second needs of a program director. In addition some precise adjustment of the operating speed may be needed to fit a specific record into a given program.

It is necessary that the level of the output does not change with repeated playback. It would be desirable to have immediate playback, but this seems impractical with present technics. In lieu of this a way is needed of positively identifying on the tape the location of specific portions of the record. The present tendency of designers to find ways of running the tape slower and slower may not be of primary importance in the broadcast studio recording field.

Studio design

A survey was made by E. J. Content, acoustical consultant with Station WOR, New York, of the major considerations of studio design as to (1) the reduction of standing waves by eliminating parallel surfaces, (2) production of the most suitable reverberation time and (3) the reduction of inter-studio cross talk and the prevention of noise infiltration.

In the discussion following this paper, the subject of the so-called public dislike for high fidelity was taken up at length. Although this idea was not disproved, a number of the contributing factors which affect the answers in such surveys of public opinion were mentioned, with the resulting conclusion that the final answer on the value of high fidelity can come about only after a number of technical, physi-

ological and psychological factors are more thoroughly investigated.

UHF ANTENNAS

In a symposium on UHF antennas, M. W. Scheldorf (G.E.) described a method of connecting circularly radiating antenna units that simplifies interconnecting multiple arrays and their balancing. This arrangement consisted of two coaxial horizontal loops in parallel planes. The lower loop is tuned with an adjustable capacitor. This adjustment is substantially the only change necessary in covering the 88-108 mc range.

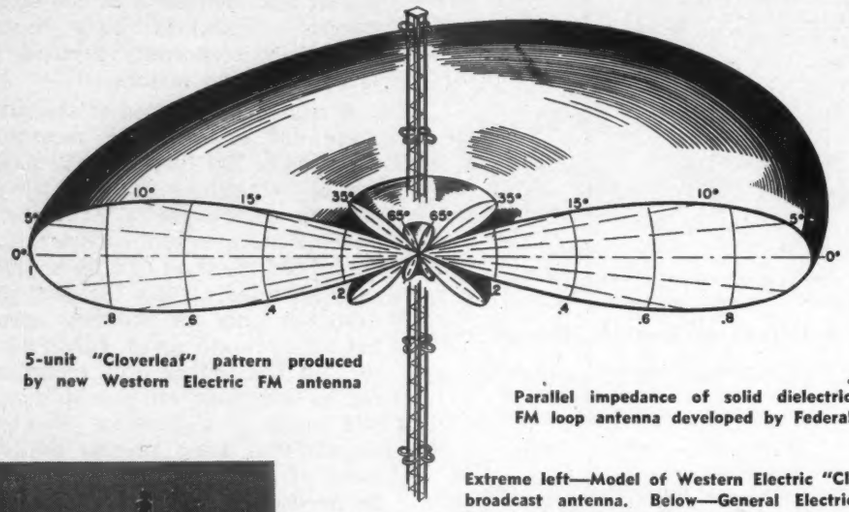
R. F. Holtz described the RCA array of turnstile elements of the wing or current sheet form. This antenna gives the widest frequency band of any described. One quadrant may be adjusted lying horizontally on ground for the operating frequency and vertical radiation patterns taken. The whole four sections can then be symmetrically disposed on the tower without further adjustments.

In the Federal type a horizontally polarized antenna consists of coordinating sections of a loop (see page 74. These loops are end fed sections with the feeder lines placed inside the loop elements.

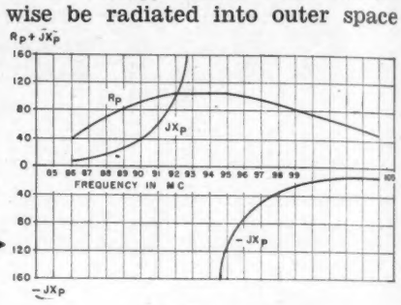
The resistance component is comparatively flat as shown. The reactive component shown here is balanced out with a matching stub adjusted for the operating frequency.

The "Cloverleaf" antenna designed by Bell Telephone Laboratories to radiate horizontally polarized waves and to concentrate this radiated energy into a service area surrounding the transmitting station was described by P. H. Smith. The new antenna is engineered particulary for use by frequency modulation broadcast stations operating at the new FCC assigned carrier frequencies between 88 and 108 megacycles and at power levels up to and including 50 kilowatts. It comprises an array of two or more vertically stacked radiating units composed of a cluster of four elements which in plan view forms a symmetrical shape similar to a four-leaf clover. A radio frequency voltage applied between the junction of the four elements and their ends causes in effect a ring of uniform current which produces a circular radiation pattern about the axis of the ring. By utilizing the directive properties of a vertical stack of such radiating units, much of the energy which would otherwise be radiated into outer space and thus lost for any useful purpose is diverted so as to increase the energy being transmitted into the station's service area.

Maximum antenna gain occurs when the instantaneous currents in all radiating elements are in time phase and of equal amplitude. These relationships are correctly established at the station's operating frequency at the time of installation by methods which do not require field or factory tuning. All radiating units are connected by means of simple clamps at half-wavelength intervals to a 3-in. diameter feed conductor which is centrally located within the tower structure. The tower itself serves

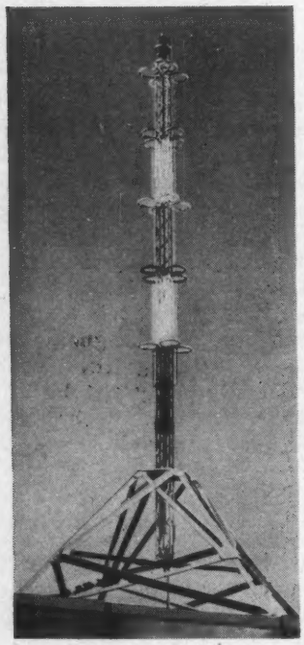


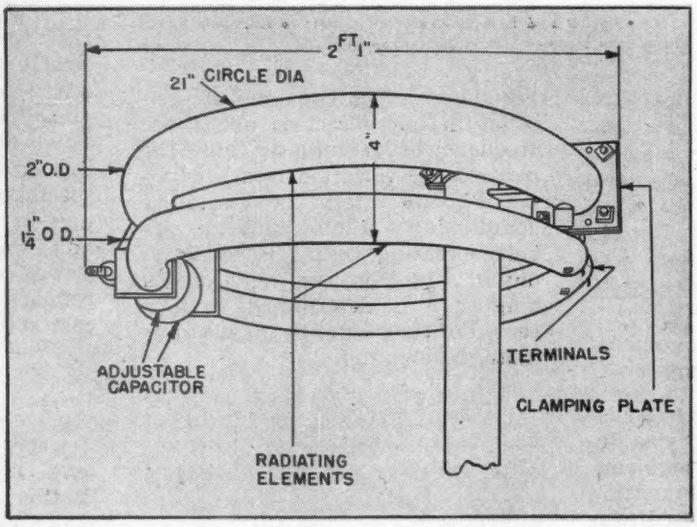
5-unit "Cloverleaf" pattern produced by new Western Electric FM antenna

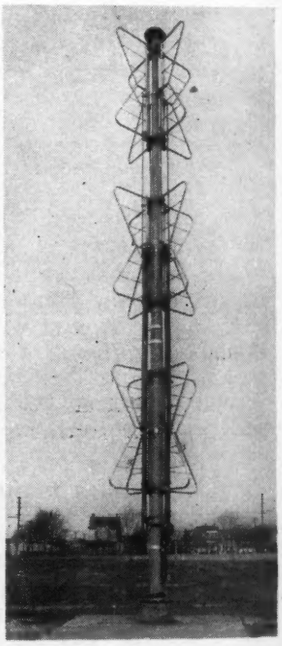


Parallel impedance of solid dielectric FM loop antenna developed by Federal

Extreme left—Model of Western Electric "Cloverleaf" broadcast antenna. Below—General Electric single-bay circular antenna. Right—RCA's turnstile elements of current sheet form







as the return or outer conductor of the feed line. The usual phase reversal occurring along such a feed line at half-wavelength intervals is compensated for by merely reversing the mounting position of the radiating elements in adjacent units. Thus, by this simple installation procedure the correct current phasing for maximum gain at the station's operating frequency is assured.

The design features of the new antenna make possible the elimination of such items as multiple transmission lines, phase correcting lines or networks, balancing lines, etc., which in present antennas prove troublesome because their length must be adjusted for the operating frequency to avoid errors in antenna current relations with a corresponding compromise in antenna gain. The tower is one-foot square and composed of an assembly of standardized structural steel welded sections.

TELEVISION STATION OPERATION

This group discussed the state of the art as far as concerns programming and the technical operation of television equipment.

The problems of handling direct studio pickups, film pickups, remote pickups and relaying were discussed, together with suggestions for training personnel and of establishing routine maintenance of all equipment.

RADIO RELAYS

H. O. Peterson (RCA Laboratories, Riverhead, N. Y.) reviewed the essential problems of UHF propagation and the rules that have been established that give an indication of the expected results from installations built expressly for relay work. It was evident that there are still many "variations of the unexpected" that must be studied before exact rules and formulas can be laid down.

STRATOVISION

The basic proposal for the use of aircraft flying at upwards of 30,000 ft., was reviewed by C. E. Nobles (Westinghouse) and W. K. Ebel (Martin Aircraft). Tests on some of the difficulties found in this system are being started so that the place that this plan will have in the television system can be evaluated.

As reported in Electronic Industries last month, Westinghouse and Martin have been conducting tests of the system over parts of the East and are understood to have achieved satisfactory results over distances up to 200 miles.

INTERCONNECTING FACILITIES

These papers presented by H. I. Romnes and W. E. Bloecker (AT&T) included a complete survey of the growth of the organizations network facilities program. Recent technical requirements have necessitated extensions of many varieties with capabilities up to 20 kc for audio circuits and up to 3 and 4 mc for television uses.

As evidence of the elaborate network facilities now in use in the U.S.A., there are 140,000 miles of 27—5000 cycle fidelity circuits now in use, connecting over 800 stations in 550 cities, together with an additional 70,000 miles of order wires. Some of these circuits have been equalized to an 8000 cycle level, and for FM station operation, connection facilities having a fidelity of ± 1 db up to 15 kc with less than 1% distortion have been made available.

The television use of twisted wire pairs found in regular cable runs was described as practicable for local television pickup applications even when losses of 94 db per mile (for 26 ga. cable) are encountered; 19 ga. cable was stated to have losses of the order of 50 db per mile. A typical installation is that from the Madison Square Garden in New York city to the RCA studios.

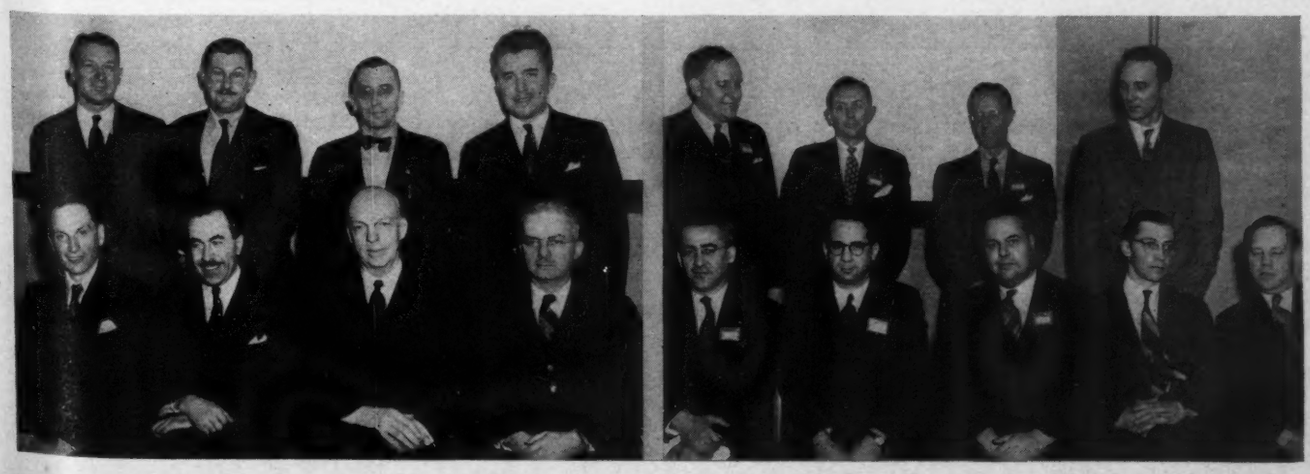
Extensive use is starting of special coaxial cables for television service with frequent booster amplifiers with associated equalizers along its length. Power to operate these amplifiers is also sent along the central conductors, eliminating the need for local power sources at each point. Work is also being done to send power along paired lines to operate intermediate amplifiers. The development of network facilities using radio relays is going hand in hand with cable developments.

Technical details of the construction of many new tubes that have resulted from wartime research were described by W. W. Salisbury (Collins Radio Co.). While much of the progress was along the line of high power pulsed tubes, still a number of interesting developments in continuous power output tubes were shown that have great possibilities in broadcast service.

In the development of the latter a definite trend seems to be toward the use of tetrodes, at least in the 100-1000 mc range. The difficulties attending the use of magnetrons in communication work will require considerable more research work. These difficulties are mainly those associated with at-

SYMPOSIUM ON PROPAGATION—Rear: Edwin W. Allen, Jr. (FCC); C. W. Carnahan; Paul DeMars, technical director Yankee network; Thomas J. Carroll, Office of Chief Signal Officer, USA; Front: J. R. McPetrie, Service Radio Development (England); R. M. Wilmotte, Consultant; Major E. H. Armstrong; Chas. R. Burrows, (Cornell)

SYMPOSIUM ON FM MODULATION METHODS: Rear: Albert James Ebel, University of Illinois; J. E. Young (RCA); W. R. David (GE); W. E. Phillips (Raytheon); Front: Dr. P. F. Panter (FTR); A. R. Vallerino (FTR); John R. Boykin (Westinghouse); James Day (REL); J. F. Morrison (Bell Labs)



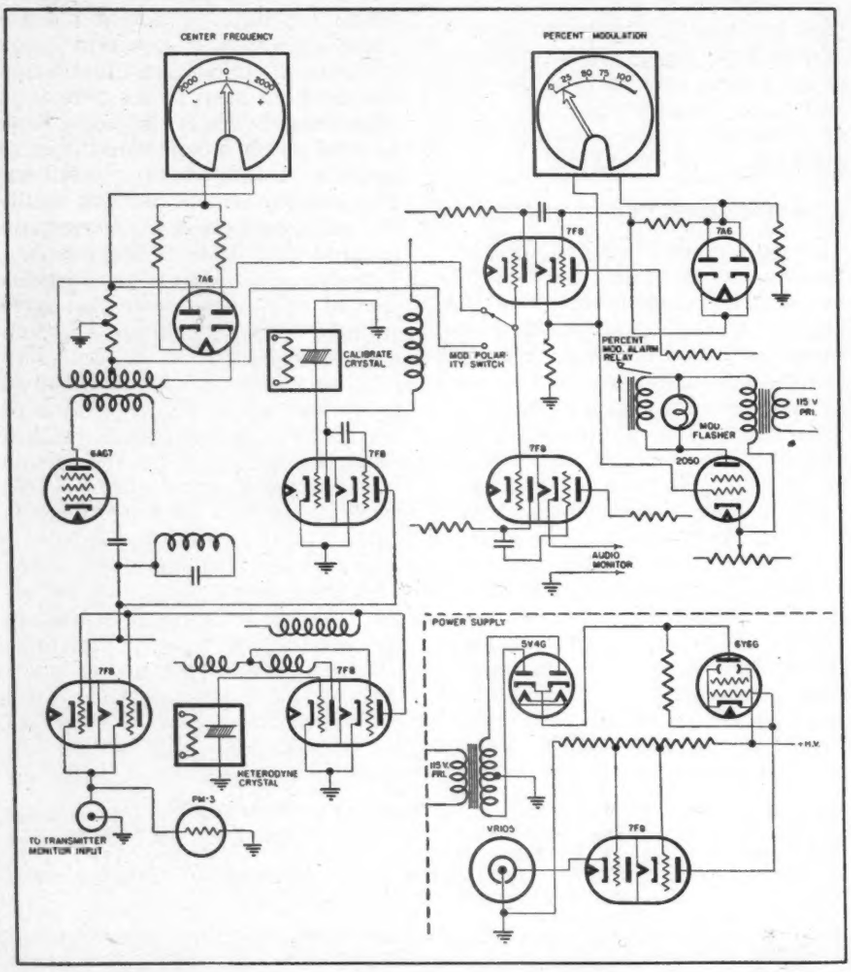
taining required frequency stability, and linear modulation (either amplitude or frequency).

In high power tube development the Resnatron was of interest. This tube, as is typical with tubes developed for high power continuous service uses heavy filaments with high emission. In this case the filament requires 1800 amperes at 2.5 v, and delivers 30 amperes peak plate current.

FM OPERATING PROBLEMS

The difficulties of FM station installations in metropolitan areas, suburban areas and mountain tops were described by J. A. Waldschmidt (WOR), Paul Dillon (WMIT), Carl Wesser (WENA) and Delmar Ports (2XOA) with suggestions as to the erection and maintenance of all facilities. Examples were the selection of the WOR site (at 444 Madison Ave., New York City) and the installation of an FM station, the station WMIT on Klingsman Peak which required a 116-mile radio relay from Winston Salem. This relay operated in one jump beyond direct line of sight, using 25 watts at 337 mc. The transmitter was 5000 ft. above sea level.

SYMPOSIUM ON TELEVISION OPERATION: Harry Milholland (DuMont); E. C. Wilbur; W. C. Eddy (Balaban & Katz); T. J. Buzalski (NBC); Scott Helt (DuMont); R. L. Smith (GE); R. E. Shelby (NBC)



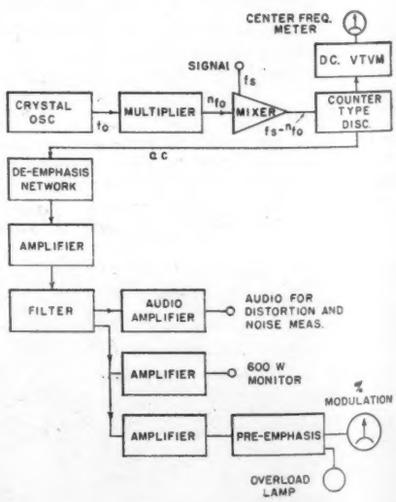
FM MONITORS

The problems of monitoring an FM station in accordance with requirements of the FCC takes equipment designs of a special nature. The FM monitor being developed by the General Radio Co. was described by D. B. Sinclair. In this circuit the discriminator used is of the differentiating-pulse counter type.

A design differing in some respects from this was described by J. R. Day of REL. The design is such that both instantaneous percentage modulation in either direction and average center frequency are continuously indicated while the transmitter being monitored is programmed. An over modulation alarm capable of being very precisely set to a known adjustable value of either polarity is included.

The General Electric version of an FM monitor was described by H. R. Summerhayes, Jr. This instrument shows mean frequency deviation, percent modulation, peak modulation indicator and also gives an audio output for aural monitoring. This instrument used a tuned circuit discriminator with special means for securing linearity over the full operating range.

At the left is shown a simplified circuit diagram of the new FM monitor and center frequency indicator developed by REL. Below—Block diagram of General Radio FM monitor-frequency indicator



INSTRUMENTATION

A brief review of the manner in which instruments are influencing and controlling production in every field

• Instrument development during World War II was centered in three major fields:

(1) Radar and allied developments (mainly uhf and pulse technics).

(2) Aircraft instruments and controls (including automatic flight and fire control).

(3) Industrial and scientific instruments (for physical research, metallurgical and chemical process control, etc.).

In general, war necessity merely accelerated the natural evolution of products, many of which were conceived before the war. In the field of instrumentation, however, certain radically new devices and technics were born, usually as the result of new components and materials rather than new principles.

For instance, uhf power measurement was made possible by development of the uhf bolometer. Special crystal detectors, of the type developed for radar reception, made it possible to greatly extend the range of frequency and impedance measurement. Improved insulation measuring instruments resulted from war research in dielectrics and tropicalization.

War's influence

Of still greater importance was the discovery that standard prewar radio components, otherwise quite satisfactory, were subject to breakdown under the extreme conditions of military use. This led to larger production of such components as hermetically sealed resistors and controls, mineral oil impregnated capacitors, ceramic tube sockets, etc., and these in turn uncovered the need for new instrumentation technics for determining with precision their quality, tolerances, etc. Again, many instrument manufacturers found that re-design of their products, using these higher quality components was of direct benefit to them in reducing spoilage and kickbacks from the field. This will apply especially to instruments manufactured for export—an important consideration when designing postwar instruments.

Electronic engineers naturally are most familiar with the applications of instruments for measuring purely electrical quantities. However, electronic instruments are being developed and applied for the measurement of practically all physical phenomena, just as electronic control is spreading to nearly all branches of industry. Such analytical instruments as the electron microscope, x-ray diffraction spectrometer, cathode ray cyclograph, engine detonation indicators, pressuregraphs and innumerable other electronic devices for industrial and scientific research now play an important part in the rigid quality control of materials and products.

To reproduce, in peacetime, the conditions which favored instrument engineering during the war is by no means impossible. The first requisite is better liaison between the instrument manufacturer and purchaser. This can be achieved by free discussion of the requirements and technology of instrumentation in all its aspects. Instrument enginering is now a specialized branch of the electronic art to which design, production and quality control engineers can turn for their instrument requirements. For reference, a general review of instrument applications is given below.

The Range of Instrument Applications

ELECTRICITY

- Capacitance
- Conductivity
- Current
- Electric charge
- Frequency
- Impedance
- Inductance
- Magnetic field
- Modulation
- Phase angle
- Power
- Power factor
- Q
- Radiation
- Resistance
- Voltage

CHEMISTRY & PHYSICS

- Altitude
- Balance
- Color
- Combustion
- Cosmic rays
- Density
- Diffraction
- Direction
- Elasticity
- Gas analysis
- Hardness
- Humidity
- Illumination
- Ionization
- Mass
- Meterology
- Microscopy
- Moisture content
- pH
- Reflectivity
- Salinity
- Size
- Sound
- Spectroscopography
- Stroboscopy
- Temperature
- Time
- Ultrasonics
- Vacuum determination
- Velocity
- Viscosity
- Weight

MECHANICS

- Balance
- Counting
- Flaw detection
- Flow
- Position
- Power
- Pressure
- RPM
- Strain
- Surface analysis
- Vibration

MEDICINE

- Brain waves
- Cauterization
- Circulation
- Cortical stimulation
- Hearing
- Heart action
- Radiation
- Shock therapy
- X-Ray

PRODUCTION BRIDGE for

By WERNER MULLER
Pan American Electronics
1650 Broadway, New York

Development of laboratory type instrument for making routine checks and accurately measuring inductance

• While the effectiveness of a choke can be determined by placing it directly in the circuit where it is to be used and measuring the hum level, this practice is satisfactory only in a few instances and it does not lead to suitable manufacturing specifications. The most effective method of specifying the inductance of a choke under actual operating current conditions, means the measurement of incremental inductance, which is the value resulting from small magnetization loops superposed on the dc flux intensity curves.

When a current is passed through an air core coil, the flux linkage is purely a matter of geometry of the coil and so the inductance of most common coil configurations in air can be calculated with considerable accuracy. When the medium through which the flux links is magnetic, a non-linear relation between flux linkage and flux produced is found and the flux linkage is greater than before. Therefore while the inductance is greater it will vary in a non-linear manner with respect to the current producing the flux. The dc magnetization can be readily ascertained by the use of the following formula:

$$H_o = \frac{1.256\ NI}{l_i}$$

Where I is the current in amperes and N represents the number of turns, and l_i is the length of flux path.

The main factor, the nature of the iron, has to be determined experimentally. The relation for ac flux density indicates that measurements can be made at one frequency and predicted for another frequency. If for example the measurement is made at 60 cycles for 6v. RMS it is the same at 600 cycles with 60v. RMS. Therefore, if the inductance of an iron core coil is measured, with suitable precautions, on a bridge for a given ac voltage at a specified frequency, the inductance will remain the same if the frequency is increased and the voltage increased in the same proportions. This permits most industrial and commercial choke coil tests to be made at 60 cycles, giving all the information desired at higher frequencies (up to several kc at least).

In the measurement of incremental inductance, the required dc must flow through the coil although the ac voltage across the coil and the operating vs. test frequencies can be juggled without affecting the answer. Although a common method of measurement is to determine the impedance in this way, the in-phase losses show up as part of the inductance value and the latter can not be directly ascertained. In bridge methods the reactance can be separated from the resistance directly.

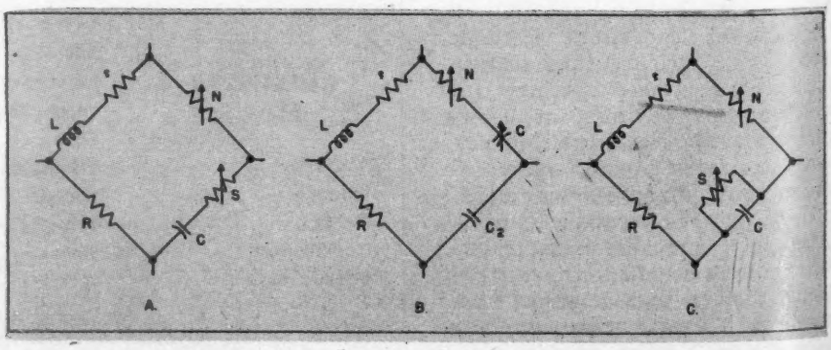
External appearance of the incremental bridge

There are three outstanding bridge circuits, the Hay bridge, the Owen bridge, and the Maxwell bridge. The basic circuits are shown respectively in Fig. 1 as A, B, and C.

Each of these bridge circuits requires two adjustments, one for reactive balance and one for resistive balance.

The Hay bridge is ideally suited for measurement of inductance where the Q is greater than 5 since the balance can be rapidly obtained. This bridge connection can be used with fully 95% of the reactors that may be submitted for measurement in industrial and research laboratories. However, if the Q is less than 5, the bridge ceases to be direct reading and corrections have to be applied. Since this correction factor is equal to $(\frac{Q^2}{1+Q^2})$, an error of 4% is found when Q equals 5, and 1% when Q equals 10. It is found in practice that with a test

Fig. 1—The Hay, Owen and Maxwell bridges shown at A, B and C respectively



INCREMENTAL TESTS

frequency of 400 cycles or more practically any inductance has a Q of over 5. As the frequency becomes lower, the Q decreases and a greater proportion of inductances met with in practice cannot be tested on a Hay bridge.

The Maxwell and Hay bridge circuits permit the resistive components to be determined directly as a Q value, while the Owens bridge gives the equivalent resistance.

The Owen circuit is more cumbersome in operation, since it requires the separate adjustment of a decade capacitor for resistive balance and the value of this capacitor becomes impractically large when the Q of the coil becomes large. Nevertheless, the bridge is ideally suited for the measurement of inductances with low Q. Both bridge arrangements permit the dc to flow through two arms, so that the measurement of the dc can be made directly.

The Maxwell bridge has the objectionable feature, that this is not the case and the dc through the inductor cannot be made direct reading. Furthermore, it is relatively unsuited for the measurement of incremental inductance especially where the Q is large, as commonly encountered in coils carrying dc. This bridge, however, is well adapted to the study of the leakage reactance in transformers. Therefore, the selection of the most useful laboratory test bridge lies with the Owen and the Hay circuits, each one being suitable for some particular types of coils.

It is of interest to examine the features of a commercial bridge that has been developed to cover the requirements of both laboratory tests and production checks, as shown in Fig. 2, a product of the Industrial Transformer Co., 2540 Belmont Ave., New York. Starting with the source of ac and dc power to the bridge, the former was selected at 60 cycles as the test frequency, with provision for the use of another frequency source externally applied if required. This selection was made because 60 cycle voltage is available with practically unlimited power from the mains, the frequency is low enough to be far removed from the resonant frequency of the usual choke, and also, this low frequency permits applying high flux densities at comparatively low voltages.

If the inductance at another frequency is desired, a decrease in the ac voltage is made in the same ratio as the two frequencies. In the bridge shown, voltages as high as 300 v at 60 cycles can be obtained, which represents voltages of approximately 4000 v at 800 cycles. For this purpose any voltage in the range from 0.01 v to 300 v can be applied by the use of Variac controls in conjunction with test transformers. A self-contained high impedance VTVM is applied while setting this voltage to a specified level. The load imposed by this voltmeter, 2 meg. and 40 $\mu\mu$f is usually insignificant but in any case, can be switched off during the balancing period.

The use of low test voltages (down to 10 mv) is necessary to simulate high frequency test equivalents. This low voltage also enables making incremental permeability tests on sample laminations, which closely approach the initial permeability of the material, getting information of value in predicting the hysteresis loss of any choke or transformer.

A precaution to reduce the effect of harmonics is the addition of a series resistance between the source of ac power and the bridge. This resistance, which is variable in semi-logarithmic steps, assures better waveform across the inductance under test.

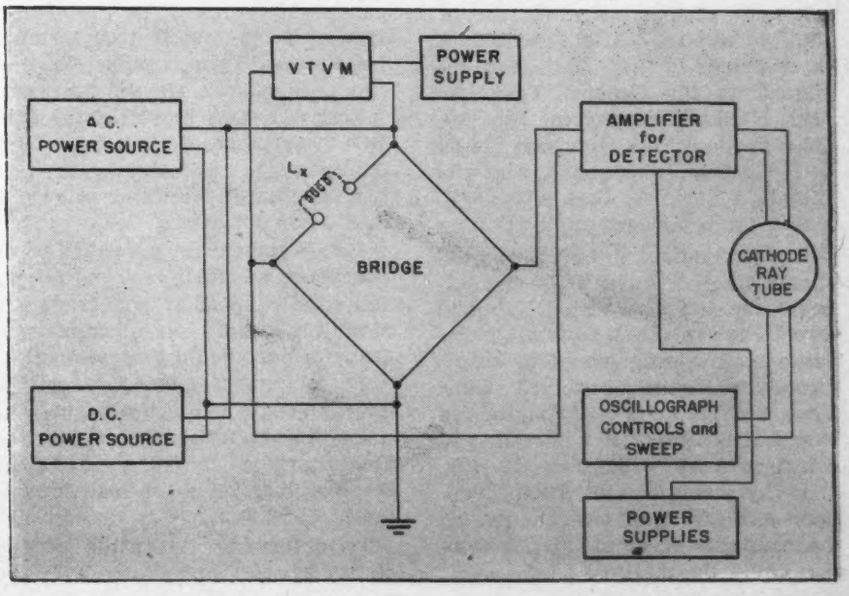
The next supply source is the dc which must be variable from zero to one ampere. This voltage is obtained from a full-wave filtered rectifier using two 3B25 tubes. The transfer circuit to the bridge contains a special choke having shielding and a hum-bucking feature which prevents the introduction of any ac components along with the direct current, which would upset the balance. The normal operating ranges are from 1 millihenry to 50 henries with 1 ampere dc, 50–500 henries with .15 ampere and above 500 henries, 15 ma.

As to the bridge itself extreme precautions are necessary that all components are fully shielded. A single switch provides either Hay or Owen bridge connections. Another switch selects one of four resistors which multiplies the range of the bridge in steps of ten. Switch 3 selects the proper capacitor. The main calibrated dial controls a semilog variable resistor with a maximum value of 11,000 ohms, in series with which is a decade resistor, adding steps of 10,000 ohms, giving a maximum resistance of 111,000 ohms. These components provide for various inductance ranges up to 1,110 henries.

At the other end, the minimum

(*Continued on page* 118)

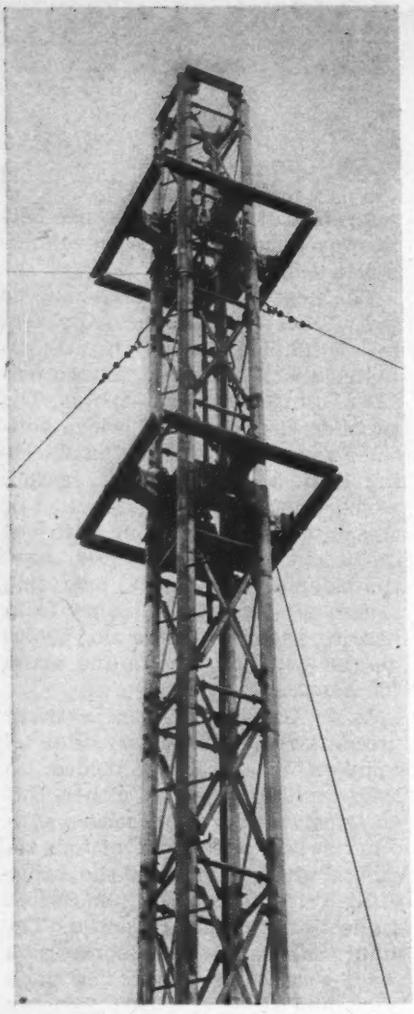
Fig. 3—Block diagram of the incremental bridge



COAXIAL FEED

By A. G. KANDOIAN
Department Head, Federal Telephone & Radio Laboratories

Design considerations for directive radiation systems, easy to feed and giving proper patterns



Two vertically stacked coaxial square loops designed for new 88-108 mc FM frequency

• The expansion in the use of high frequencies in many communications and broadcasting networks, plus the high cost of power at these frequencies, has accentuated the need for economical, directive radiation systems. The antennas to be described in this article were designed at the Federal Telephone and Radio laboratories for just that purpose; for they are simple to feed, easy to construct, and give radiation patterns that are ideally suited for broadcast applications.

In particular these antennas should be of interest to F-M engineers, for they give a high degree of directivity in the vertical plane while maintaining complete omnidirectivity in the horizontal plane. Type I (Fig. 1) is a coaxially fed loop which sends out a horizontally polarized wave, while Type II (Fig. 2) is this same loop to which a vertical antenna has been added so that circular or elliptical polarization could be obtained.

While the design of ultra-high-frequency loops has been described by several investigators [1-4], in every case these loops require the use of impedance matching or balancing networks which entailed the use of extraneous equipment. In this system the radiators, as well as the supporting structure, act as the matching circuit so that the antennas can be designed to have an impedance which matches any standard cable such as a 50-, 70-, or 100-ohm line. No stubs or balanced feeders are necessary.

A typical illustration of how this is accomplished is indicated in Fig. 4, which is the equivalent electrical schematic of the four element loop shown in Fig. 3. As seen in this figure the input impedance of the antenna circuit should be 100 ohms, and consequently the resistance of each section, since all four are equal and in parallel, must be 400 ohms.

The other fixed parameter in this system is the antenna terminal resistance which is a function of the diameter of the loop and cross-section of the radiator, and in this case is 1600 ohms. The problem, of course, is to match this terminal impedance to the required 400 ohm input impedance via the two coaxial quarter wave transformers (AB-BC) whose characteristic impedance can be made any value by the proper selection of the inner and outer conductor diameters.

Before indicating the calculations necessary to effect this match the following expression from transmission line theory on quarter wave transformer should be reviewed:

$Z_m = Z_o \times Z_L$, where Z_m is the characteristic impedance of the matching transformer; Z_o is the characteristic impedance of the feeding line; Z_L is the load impedance.

To determine the value of the characteristic impedance of the matching transformers (AB-BC), it is advisable to work from the antenna toward the transmission line. First examine the circuit to the right of X on Fig. 4. In this case Z_m was chosen to be 100 ohms because it is the most practical value to use. If this line (AB) is to act as a quarter wave transformer, Z_o must be:

$$Z_o = \frac{100^2}{1{,}600} = 6.25 \text{ oms}$$

Using this value as the output impedance of the circuit to the left of X and knowing that the input impedance of the section must be 400 ohms, then the characteristic impedance of the line from B to C must be:

$$Z_m \text{ (bc)} = 400 \times 6.25 = 50 \text{ ohms}$$

Thus it is possible by use of ap-

Fig. 1—Close-up of coaxially fed square loop antenna designed for 550 mc frequency

FM LOOP ANTENNAS

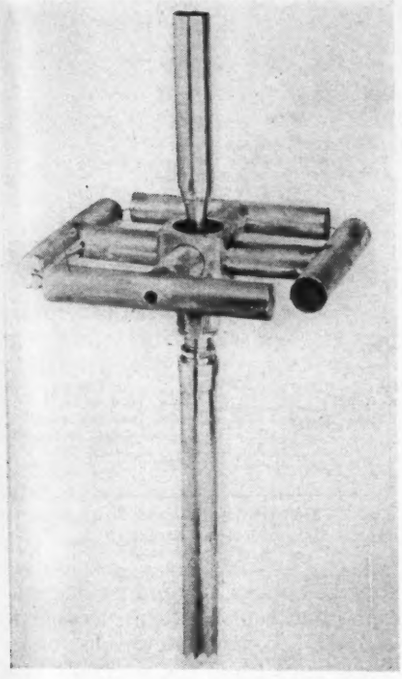


Fig. 2—Square coaxially fed loop antenna of "electric-magnetic" type for 1200 mc

propriately dimensioned radiators and supporting structures to match the loop to any coaxial cable. In addition, as indicated in Fig. 3, no limitations other than practical, exist for the number of elements making up the loop. Thus, a loop of any diameter may be constructed and the current distribution maintained essentially constant. The limitation of small loop diameter compared to wavelength need not be observed.

The radiation pattern of the loop with substantially uniform current distribution, and with diameter small compared to a wavelength, is well known. In the plane of the loop the radiation is non-directive, while in the perpendicular plane it varies approximately as $\cos\beta$, where β is the angle measured between the plane of the loop and the test position.

In the more general case of a loop with any sized diameter and uniform current distribution, the radiation is still omnidirectional in the plane of the loop. However in the perpendicular plane Foster[4] has shown that the pattern is of the form: $J_1\left(\pi \frac{d}{\lambda} \cos\beta\right)$ where d is the loop diameter; λ the wave-length J_1 the Bessel function of the order unity.

Bandwidth of the loop

One of the most important considerations in the design of any antenna is the bandwidth or change in input impedance versus frequency. In this system the bandwidth is a function of three parameters: the diameter of the loop, the cross-section of the radiator and the impedance of the quarter wave transformers. In general the lower the difference between Z_o and Z_L, the lower the "Q" of the circuit and consequently the wider the bandwidth. Thus it is possible to design a radiator of this type to meet most practical bandwidth requirements.

At uhf the most practical method of measuring this change of input impedance versus frequency is by noting the mismatch that occurs as the frequency is varied. This mismatch, which is due to reflection from the antenna, can be most conveniently measured in terms of the standing wave ratio (SWR) existing on the transmission line leading to the antenna.

A typical measure of the standing wave ratio versus frequency is shown on Fig. 6. A 50-ohm line was used to feed the loop and as indicated on the figure, a fairly wide bandwidth resulted. Other experimental models were constructed at Federal Telecommunication Laboratory to increase and decrease the effective bandwidth and on the whole they agree with the theoretical considerations.

In this connection it is important

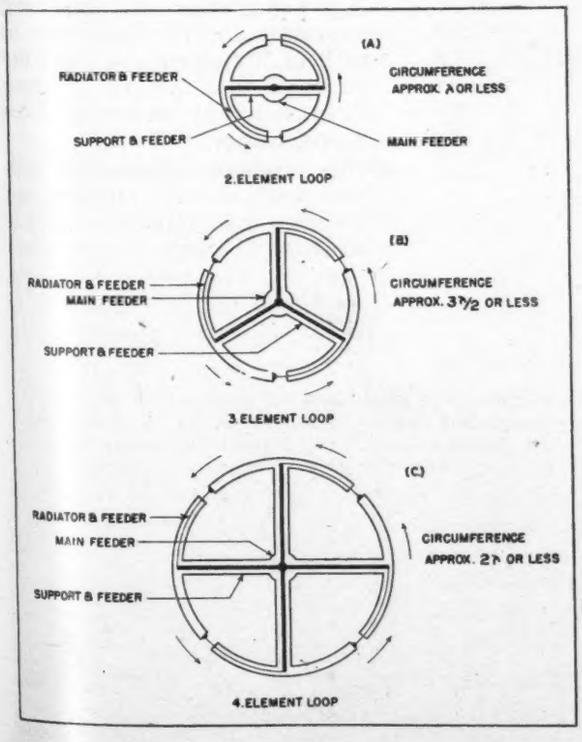
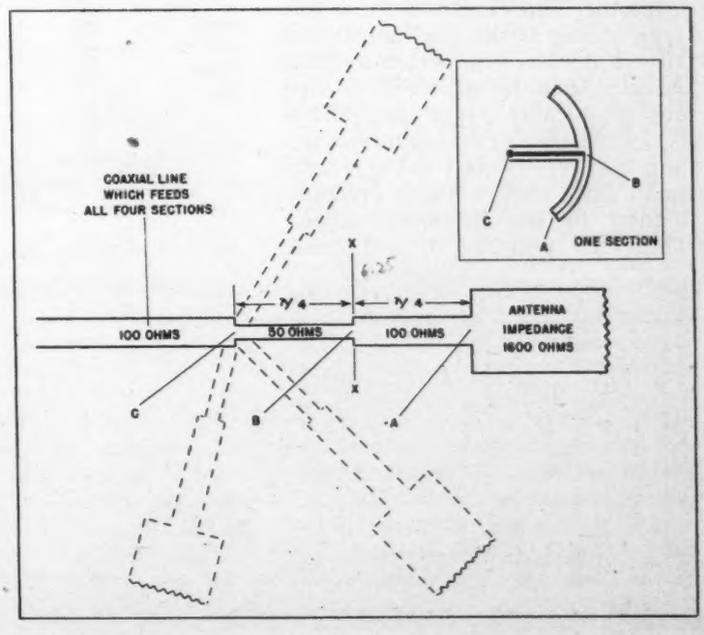


Fig. 3 (Left)—Schematic of coaxially fed loops showing dimensions and feed arrangement. Fig. 4—Equivalent electrical circuit of 4-element loop



to note that the standing wave ratio effects the total attenuation of the transmission line system feeding any load, in particular an antenna. Where long lengths of line are used it is important to keep the SWR to a minimum, otherwise the total attenuation is increased. This problem has been discussed in a recent paper[6]. The total attenuation is given by:

$$A = A_o + 10 \log_{10} \left(\frac{1-\triangle^2_L \epsilon^{-0.46A_o}}{1-\triangle^2_L} \right),$$

where A is the total attenuation; A_o is the normal attenuation; $\triangle_L$ is the reflection coefficient.

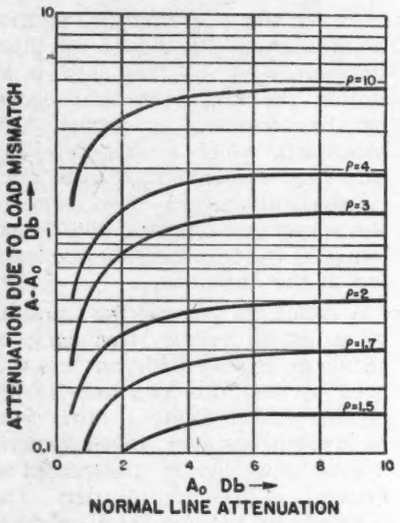


Fig. 5—Attenuation due to mismatch

Fig. 5 is a graphic representation of the attenuation increase due to mismatch and as seen on this chart a SWR of 2 to 1 on an 8 db line will cause only a .5 db increase in attenuation.

Stacking technic

Another important feature of this type of loop is the mechanical and electrical ease with which vertical stacking can be achieved to give any practicable power gain. This is true because electrical intercoupling between stacked loops is very small since each radiates predominantly in the horizontal plane. Thus, the presence of additional loops does not affect the impedance of the first loop. Fig. 7 depicts two experimental loops built as a pair and spaced approximately one wavelength apart. The input impedance to the pair is 50 ohms and it can be tuned over a wide range of frequencies with the stub. At this point is should be noted that the antenna can be constructed for just one frequency, in which case no stub is needed, or for several frequencies with the use of a stub.

Any number of such pairs may be stacked to give the desired power gain. At the junction of the transmission line of any two pairs, however, a 2-to-1 impedance correcting network is required to raise the antenna impedance to the impedance of the line. This is commonly accomplished by means of a quarter wave transformer. Fig. 8 shows the schematic of a feeding system for a stack of four loops for FM broadcasting while Fig. 9 gives the necessary theoretical data to show what spacing to use between loops and what gains may be expected due to the vertical stacking when equal currents are fed to successive loops.

A directive vertical pattern essentially free from minor lobes also

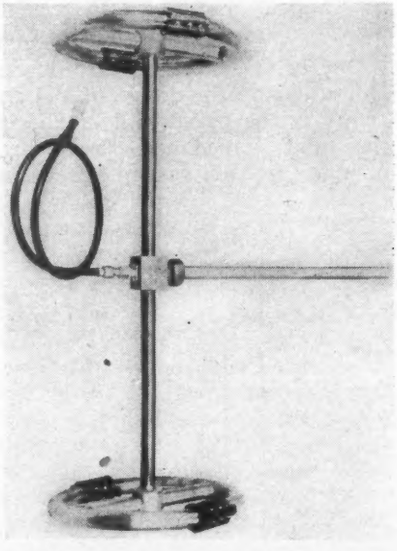


Fig. 7—Stack of two loops with tuning stub

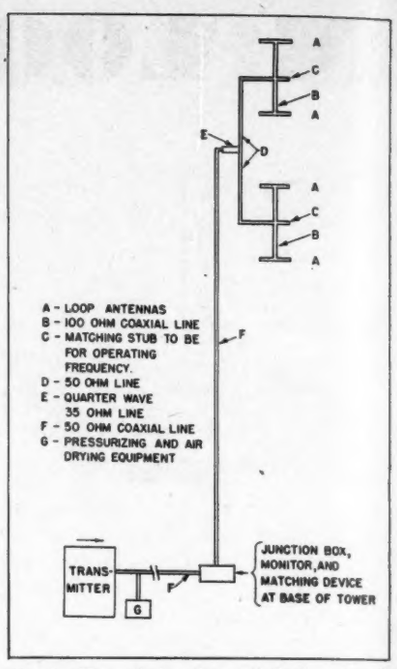

A - LOOP ANTENNAS
B - 100 OHM COAXIAL LINE
C - MATCHING STUB TO BE FOR OPERATING FREQUENCY.
D - 50 OHM LINE
E - QUARTER WAVE 35 OHM LINE
F - 50 OHM COAXIAL LINE
G - PRESSURIZING AND AIR DRYING EQUIPMENT
TRANS-MITTER
JUNCTION BOX, MONITOR, AND MATCHING DEVICE AT BASE OF TOWER

Fig. 8—Transmission line and feed system for typical FM broadcasting antenna

may be obtained by proper distribution of current between successively stacked loops[5]. However, under these conditions the overall power gain from a fixed number of loops is reduced.

Summarizing, this loop sends out a horizontally polarized wave which is directive in the vertical but omnidirectional in the horizontal plane. Its characteristics and relative merits are:

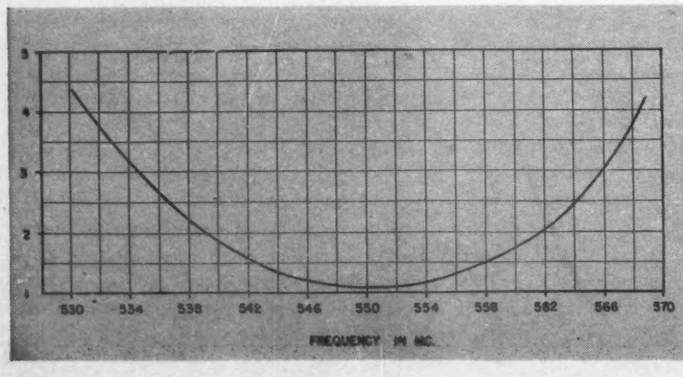
a) No balanced feeders are necessary.

b) No stubs are needed for matching, hence, the full bandwidth capability for the loop may be realized. A stub may be found desirable to tune the loop, or group of loops, to any frequency within a large range.

c) No insulator mechanical supports are necessary. Metallic supports are used, rigidly fastened to the mast and radiating members.

d) Any size loop may be built with essentially uniform clockwise or counter-clockwise current distri-

(*Continued on page* 122)



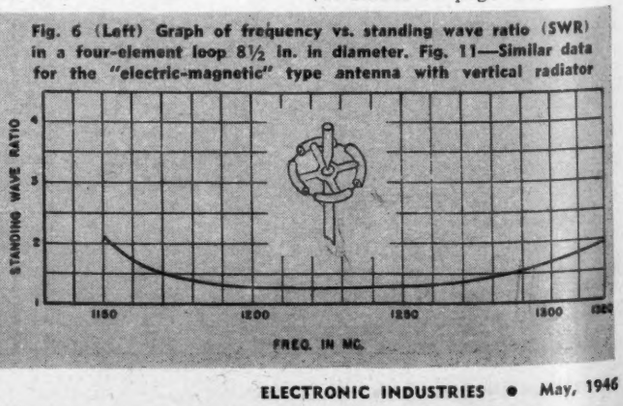


Fig. 6 (Left) Graph of frequency vs. standing wave ratio (SWR) in a four-element loop 8½ in. in diameter. Fig. 11—Similar data for the "electric-magnetic" type antenna with vertical radiator

COIL SHORT TESTS

By NORMAN L. CHALFIN

Simplified method developed for fast production inspection capable of detecting single shorted turn in adjacent wires

• In the mass inspection of coils it frequently is necessary to determine whether there exist shorted turns. A short appearing between adjacent turns or between wires separated by several turns cannot readily be observed by inspection. With fine wire coils a resistance measurement would be unlikely to show the presence of a short. Bridge methods of testing are possible but require careful adjustment and may not be adaptable to production personnel use. The method described has proved successful for an unskilled production components tester and has sensitivity great enough to detect a single shorted turn between adjacent wires forming essentially a closed loop, or shorts between turns many wires separated. An indication can even be observed when the leads of a perfect coil with as many as fifty thousand turns are shorted together.

The circuit diagram of Fig. A shows the electrical connections. Fig. B shows the mechanical arrangement used by the writer for use with recorder and playback coils.

The operating principle is well known. When a closed loop is brought close to a source of alternating current power, the loop will absorb energy from the source and if the source is poorly regulated there will be a dip in the source voltage. In the application described the "source" is the secondary winding of a transformer. The secondary is split and the two halves connected in phase opposition so that if the voltages in the two halves are equal the net output to a measuring instrument should be zero.

The transformer takes on any convenient form. It is suggested that the coil tester be constructed from the same types of coils as those under test. It is a simple matter to construct the arrangement of Fig. B with any type of coil. The iron core protrudes from the housing of the transformer and should preferably be shaped to fit the coil form.

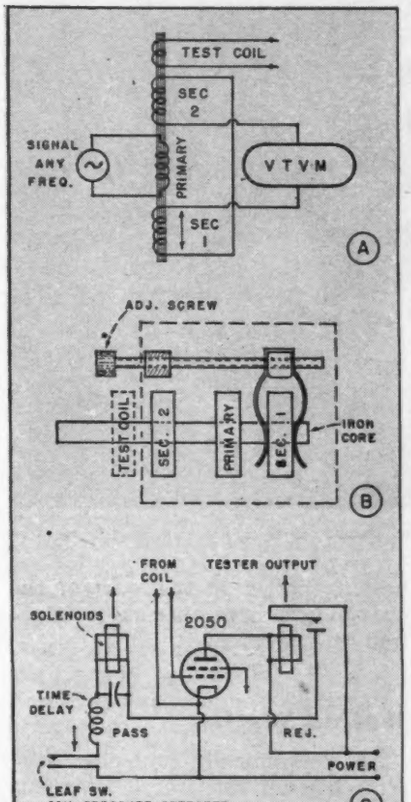


Fig. A is the circuit diagram of the tester; B shows the mechanical arrangement of the device; C indicates solenoid reject plunger

Operation of the test set is simplicity itself. The test coil is placed over the core. If it is unshorted and OK there will be no indication on the meter. The existence of any shorted turns will cause the meter to indicate some increased value of voltage. This will result from the unbalance of the phase opposed voltages in the split secondary. The unbalance is due to the absorption of power from that half of the secondary nearest the test coil.

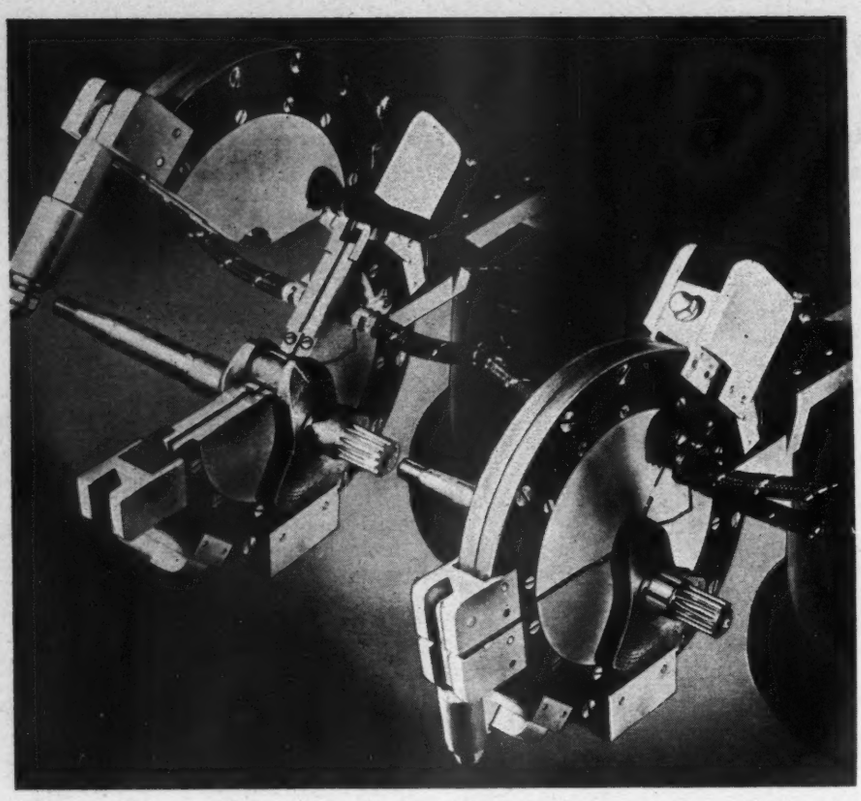
The core material is not critical. Powdered iron, Armco soft iron, and ordinary tool steel have been used with success. Powdered iron is best, giving the greatest indication with the same coils. Hypersil transformer laminations also have been used successfully with results about equal to powdered iron.

The following operating notes may be of interest. The zero adjustment consists of a phosphor bronze spring clip cemented to a threaded hex bushing and is adjusted from a knob on the panel. The unit is zero set with a coil known to be good. An absolute zero adjustment is not necessary. It will not be entirely possible with some arrangements. In this case "zero adjustment" consists of adjusting for minimum voltage indication on the ac voltmeter or VTVM. The latter is preferable since more sensitive indications are possible.

While we have indicated "any" frequency as that at which the test set may be operated, there is a frequency for the set-ups which is an optimum value. This is the resonant frequency of the system and generally will be an audio frequency of several thousand cycles for phonograph pickup coils or recorder coils. For rf coils the frequency probably will be near the resonant frequency of the unit if designed for iron core use. For transformer windings, it probably will be some low audio frequency.

The system lends itself to automatic operation to the extent that a solenoid reject plunger can be operated in the plate circuit of a thyratron whose grid is controlled by the change in ac voltage when shorted turns appear. A plunger throwing in another direction can be made to operate after a small time delay if there are no shorted turns. No details are shown in Fig. C because every set-up would require a specific physical arrangement. The block diagram shows the circuit action for this automatic operation.

TUBES ON THE JOB



Split coil jig for electronic heating of eccentric shaped parts speeds up production flow

Split Coil for HF Heating

For electronic hardening and brazing operations on such units as crankshafts and camshafts, a new multi-turn split coil has been engineered by Induction Heating Corp., 389 Lafayette St., New York 3, N. Y. Single turn split coils have been in use for some time but in coils of less than 1 in. diameter insufficient energy is transferred to produce the normally high quality results expected from induction heating. Using a frequency of 375 kc, power concentrations as high as 20 kw per sq. in. on a ½ in. diameter shaft have been obtained with this Thermonic multi-turn split coil. Journal areas on small diameter shafts can be hardened to a depth of twenty to thirty thousandths of an inch.

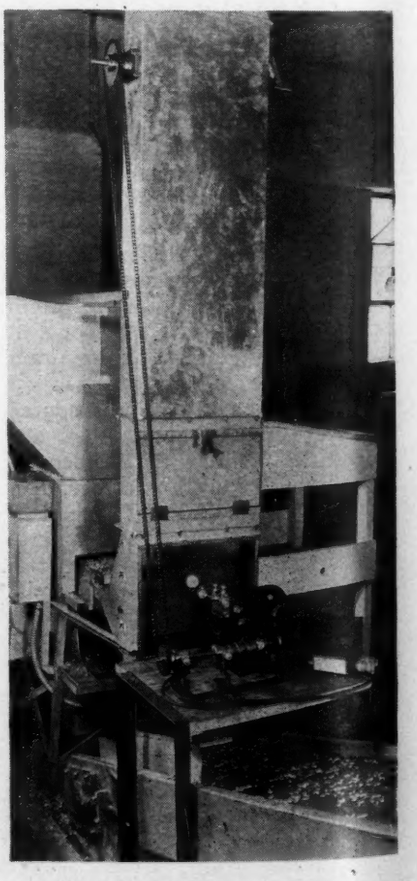
Another feature of this coil design is the possibility of using the coil either with or without internal quenching. For internal quenching the quench medium is carried between the copper-plate turns and allows quick cooling of the heated metal without removing the work from the coil. By eliminating this time delay from the end of the heating period to the start of the quench excessive thermal conduction is prevented.

Walnut Sorting

An electronically controlled sevromechanism has solved a serious difficulty that had developed in the California Walnut Growers Association's process for the automatic separation of cracked shells from walnut meats. The meats and shells are fed into an air separation throat which carries an air stream of approximately 2000 feet per minute. With proper air velocity the shells are floated away and the meats drop into boxes or on conveyors. While this action seems reversed on first thought, the SpG of the shells being heavier than that of the meats (1.1 to 0.9), the irregular shape of the shells produces enough drag-coefficient so that they and not the meats are carried away by the air stream if the correct velocity is maintained. Varying amounts of material induced in the air stream have a pronounced effect on air velocity. Increasing the volume of meats and shells reduces the velocity of the air and a large quantity of meats may drop with the shells. If the flow of material decreases, the velocity speeds up and several hundred dollars of meats may be carried away with the shells hourly.

A Motron electronically controlled servomechanism, made by W. C. Robinette Co., South Pasadena, Cal., now automatically governs the correct air velocity in the sorting chamber regardless of the amount of walnut meats and shells fed into the separator. A ping-pong ball used as a drag sphere is fastened to the governor actuating arm of the Motron and extends into the air stream through a slot in a glass window. An adjustable counterweight on the governor arm is used for a control setting of arm positioning for any pre-determined velocity. If the velocity rises or drops away from this pre-determined value the ball and governor arm also rise or drop with the changing air drag. The control mechanism through the chain drive then moves the damper for re-establishment of the proper velocity.

Separation throat for walnut sorter; meats drop to conveyor for additional processing



The damper motor control is electronic in operation and functions without relays. The control action is accomplished by the angular position of a contact which is governed by the position of the ping-pong ball with a current of the order of a few microamperes. Maximum movement speed of the damper is 5° per second.

In the Motron servomechanism system any deviation of the governor arm from a pre-determined position results in the electronic controller feeding energy into the motor control to re-establish proper velocity so that the drag sphere returns to its zero position. This energy is proportioned to produce comparatively fast movement of the damper if the damper position needs considerable correction, but as the damper position approaches the proper closure to produce the required air velocity the movement becomes progressively slower.

Heat-sealing Vinylite Play Balls

Swinging their electronic heating equipment from the war-time needs of making solar stills, DuPage Plastics Co., Lombard, Ill., are now fabricating giant, light-weight play balls. Manufactured of Vinylite with a wall thickness only 0.006 inch, these 22 in. diameter balls are virtually indestructible. High frequency electronic heat - sealing makes airtight, waterproof seams that are as tough as the thermoplastic material itself. An RCA 2-kw electronic power generator is used for the sealing operation and provides lower operating costs than any other seam sealing method. A separate water-proofing operation would be required were the seams stitched in the conventional manner.

Hf seam sealing of Vinylite balls is fast

Faintest of heart reactions are amplified and recorded instantaneously by this unit

Electro-cardiograph

• A direct-writing electro-cardiograph has been developed by Electro-Physical Labs., Inc., 45 West 18th Street, New York under the name, Cardiotron. The instrument makes it possible to record instantly and permanently standard heart action curves, eliminating photographic and darkroom procedure.

It is completely housed in a mahogany case that is easily portable. The instrument consists of a set of four applicators with suitable switching means so that any pair can be applied to the balanced amplifier which delivers driving power to a rugged electrodynamic recording pen writer unit. The tape is pulled through at a fixed rate by a synchronous motor drive and in addition a marking signal can be applied at one second intervals if desired to check timing axis accuracy.

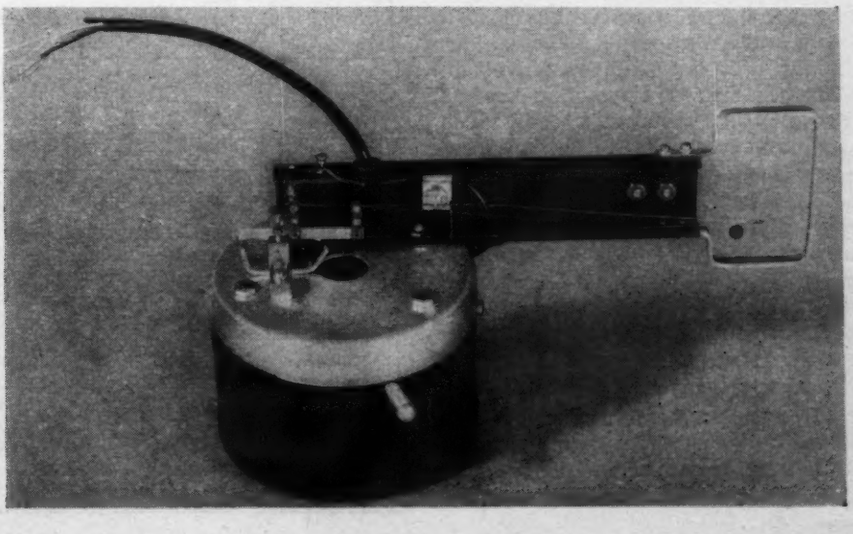
The heart of the instrument is the amplifier which gives a gain of about 90 db using standard tubes. The electro-dynamic type of recording unit produces on an especially processed wax coated paper the familiar graphic pattern.

Recording is inkless, which permits complete portability, as there are no inkwells to spill or tubes to clog. The marking is accomplished by an electrically heated loop of wire at the end of the pen arm.

The circuit contains all standard features associated with electrocardiograph equipment, and in addition numerous items dealing with the reduction of interference, an automatic disconnect should excessive interference appear, a "good ground" indicator, standardization checks for both deflection amplitude and chart speed, etc. The instrument weighs 34 lbs. and operates from the ac lines.

Equipment of this kind frequently is used to observe a patient's heart action during surgery or for research projects. An electrocardiogram has become an important item of medical diagnosis because of growing concern about heart disease, which is one of the leading causes of death in the United States.

Stylus driving mechanism of electro-cardiograph is a linear galvanometer with high deflection speed. A special chemically treated paper tape is used with an electricaly heated stylus tip



★ *ELECTRONIC MARKETING*

CULTIVATE EXPORTS!

By H. GREGORY SHEA,
Associate Editor Electronic Industries

Sales competition may arrive sooner than expected and foreign markets will represent a welcome cushion

• Speaking at the opening of a drive to help feed Europe, started in early March, former President Hoover said of the European situation, "Famine is the inevitable aftermath of war."

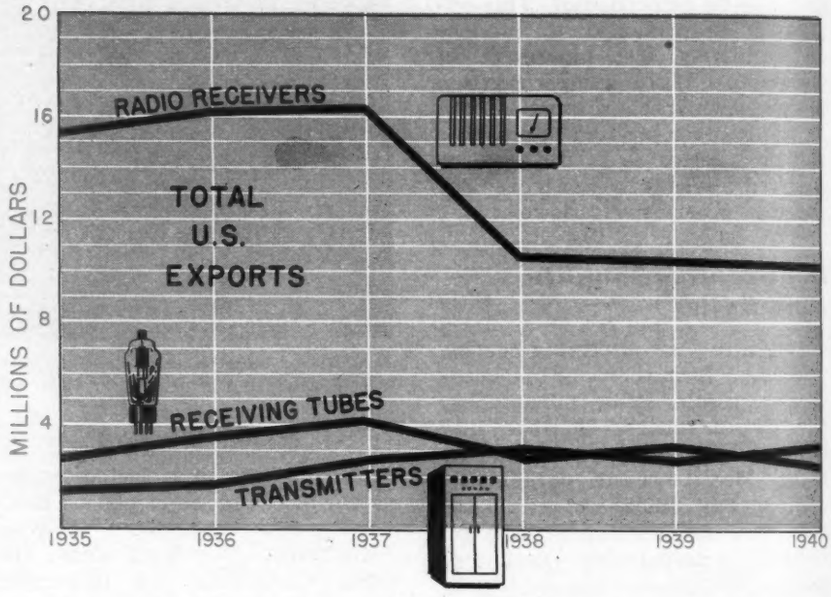
It is well for the radio manufacturer to realize another economic fact of great importance to him, namely, that a slump in demand after an initial spurt is also the inevitable aftermath of war.

During a war, particularly a total one such as we have just been through, no purchases of radio sets and other durable goods are made. This results in a concentration of demand immediately afterwards. When this demand has been satisfied, a large proportion of the potential buyers, possessed of new merchandise, will be out of the market entirely for a certain time.

Furthermore, the wise manufacturer will take with a grain of salt the predictions that are so freely being spread around that the demand for durable goods of all kinds, including radio sets, is so large as not to be capable of fulfillment for several years. He should remember that if he goes to five stores trying to buy a white shirt, each of the merchants will be convinced that he has lost a sale and will report it, whereas actually only one shirt was involved. Also the current wave of strikes has meant that in a very real sense employes of strike-bound companies have been eating the savings which they expected to spend on new radios and home equipment. These losses from the pent-up demand are irrecoverable.

Thus sales competition may arrive much sooner than expected. Where then will the radio manufacturer sell his sets?

If past performance is any criterion, he will, in common with hundreds of others, hit on the thought that he can fill the void



Above, in chart form, and below in figures are statistics for total US exports to all countries

TOTAL U. S. EXPORTS	1935	1936	1937	1938	1939	1940
Transmitters	$1,578,400	$1,817,216	$2,684,336	$2,957,896	$2,695,790	$2,287,879
Receiving Sets	15,471,721	16,041,147	16,128,572	10,553,547	10,448,017	10,157,423
Receiving Tubes	2,882,145	3,514,263	4,063,517	2,973,059	3,000,701	2,451,920
Total	$19,932,266	$21,372,626	$22,876,425	$30,306,898	$16,144,508	$15,897,222

Below are statistics covering exports of principal components to ten largest importing countries

	TUBES	RECEIVERS	TRANSMITTERS
Brazil	$969,922	$7,780,907	$714,302
Chile	315,373	2,067,290	257,022
Colombia	152,485	2,915,865	794,449
Cuba	267,219	4,403,281	503,413
British India	167,511	2,374,166	136,343
Mexico	474,710	9,330,379	799,928
Philippine Islands	108,158	1,693,420	482,600
United Kingdom	1,282,669	7,194,677	768,811
Union of South Africa	490,250	9,218,974	342,056
Venezuela	126,584	2,450,774	515,591
Total	$4,354,881	$49,429,733	$5,514,515

in his demand by invading the export market.

The export market, however, is no different from any other market. It must be cultivated and cultivated tenderly! Perhaps the only important difference is that the exporter can count on a much greater loyalty on the part of his foreign correspondents—if he has treated them well—than on the part of domestic dealers. This loyalty goes to the extent of overcoming an unfavorable price differential. Of course, this is not because the foreign importer is a finer fellow than the domestic dealer, but because distance makes acquaintance difficult and the wise business man deals with those he knows rather than with strangers.

Building a market

Emphasis must be laid, however, on the proper cultivation of the market. In building up a market for any kind of goods, whether it is in this country, or for that matter anywhere else in the world, the seller who wants to succeed makes every effort to initiate and build up personal contacts with his customers. This is of such obvious importance that in many of the smaller companies, and indeed even in the largest the head of the business reserves the making of such friendship to himself as part of his important activities. In any event it is the usual practice to have forces of salesmen to maintain and expand this personal relationship with customers.

To attempt, therefore, to reverse this policy in respect to foreign buyers seems foolhardy. Certainly their remoteness makes them that much more grateful for the compliment of a personal visit, and often that gratitude is shown by a scale of entertainment so lavish as to be almost embarrassing.

While such friendships can be initiated by visits, they are cemented by delivery of goods, particularly in times like these. In the early 1920's there was a popular song whose lyrics were: "You've got to kiss your mama every night or you can't kiss your mama at all—or she won't be home when you call". The little nugget of wisdom included in this song is quite obviously applicable to relations with foreign customers.

Unless you, Mr. Manufacturer are prepared to allocate a part of your production to the export market now even though you cannot supply the domestic market, you will find it mighty difficult to break in on established relations with other makers not only in this country but in Holland, England and other pre-war exporting countries as their capacity becomes built up in the coming recovery period.

Country	Is Import Permit Necessary?	How Is Exchange Obtained?	Local Selling Rate for Dollars for Imports†	Remarks
°Brazil	Since July 26, 1945, Import Permit required for extensive list of specific goods; copy of Permit must be sent to United States exporter for consular visa. Validity 150 days; permit may be obtained by cable through importer if an order is unaccompanied by license.	(a) Import Permit implies allocation of Foreign Exchange upon clearance. Other goods receive Exchange through application to the Banco do Brasil (Export-Import Department).	Free Market . . . Cruzeiros 19.50 per $1, plus 5% tax.	Exchange may be applied for prior to clearance, upon filing "bond" to produce customs documents. Used machinery imports require inspection certificate. Importers may purchase forward delivery exchange.
Chile	Yes. Import Permit valid for 12 months for the United States.	Through collecting bank which holds control documents until exchange is obtained. Import Permit authorizes purchase of Foreign Exchange.	"Export draft" rate, in payment of specific essential imports: Pesos 25.10 per $1. "Blanqueado" or "D.P." rate, for all other imports: Pesos 31.10 per $1.	Customs retains goods until import clearance and exchange permits are produced. A provisional Trade Agreement with the United States was signed July 30, 1945, for one year.
°Colombia	Yes, subject to monthly quota allocations. (See last column.) Copy of written order must be attached to Import Permit application. (Import license good for one year.)	(a) On the strength of Import License, which carries right to Foreign Exchange. Customs manifest in order to secure exchange no longer required; instead B/L, commercial and consular invoice sufficient.	Rate for the 5 import groups: Pesos 175.50 plus 1% tax and 5 centavos per dollar coffee tax, or a total of Pesos 182.25 per $100.	Effective June 1, 1945, importations into Colombia divided into 5 groups for purpose of establishing monthly Import License quotas subject to various guarantee deposits. Import license must be sent to exporter for presentation to Consul at point of shipment with shipping documents.
°Cuba	No.	Exchange Permit required; validity not limited.	Peso 1 per $1, plus 1/10% exchange commission.	2% Public Works Tax is levied on all payments and transfers of funds abroad, with certain temporary exceptions.
India (c)	Yes. (Quotas for certain goods.)	(d) Through authorized banks.	Rupees 332.25 per $100.	Imports can only be paid for in currency of country of origin of goods.
°Mexico	No, except for artificial silk fibres and certain iron and steel products enumerated in the official Gazette of Sept. 29, 1945, which remain subject to import restrictions.	No exchange restrictions. Import Permit, where required, assures Foreign Exchange.	Mexican pesos 4.86 per $1.	Monetary Stabilization Agreement between United States and Mexico extended till June 30, 1947. Importers may purchase forward delivery exchange against immediate deposit of Mexican peso equivalent.
Philippine Islands	Yes. (See last column.)	No exchange restrictions, but transfers require Foreign Funds Control approval in Manila, which is readily granted for bona-fide transactions.	Pesos 2 = $1.	Effective Sept. 20, 1945, firm order must be submitted to F.E.A. in Manila for assignment of registry number for transmittal to American exporter; this is a prerequisite to application for export license where required and necessary for space allocation.
°United Kingdom of Great Britain and Northern Ireland (c)	Yes, for most articles.	(d) With prior Import Permit and Exchange Permit.	£1 equals $4.02½.	The British Defense (Finance) Regulations 1939 as amended are generally adhered to in the whole Sterling Area.
Union of South Africa (c)	No, except for goods requiring United States Export License, for which certificate of essentiality is still necessary.	(d) Through authorized banks.	South African £ — about $4.00½.	———
°Venezuela	No, except for specific list of goods. (See last column.)	Through local banks, not depending upon arrival or clearance of goods. Import Permit where required carries right to Foreign Exchange.	Bolivares 3.35 per $1.	Decree Sept. 15, 1945, established yearly import quotas for 11 Tariff Items; pending establishment of fixed quotas, these articles are subject to Import License. Import License number should be indicated on consular invoice. "To Order" shipments not permitted.

(a) A provisional deposit of the local currency equivalent may made with the collecting bank; the relative merchandise is then cleared through customs. The application for exchange must be accompanied by the customs certificate indicating payment of custom duties on a bona fide importation.
(c) Countries belonging to the BRITISH STERLING AREA, which, according to the British Defense (Finance) Regulations 1939, as amended October 19, 1944, now comprises the following territories, excluding Canada and Newfoundland: United Kingdom, any Dominion, any other part of the British Dominions, any British-mandated territory, any British Protectorate or protected States, Egypt, Anglo-Egyptian Sudan, Iraq, Iceland, and the Faroe Islands.
(d) In line with the British Defense (Finance) Regulations, Empire countries have been authorized to require Permits for imports from non-sterling countries, which Permits automatically provide foreign exchange in cover.
(°) Countries with which the United States has a Reciprocal Trade Treaty (Great Britain includes the British non-self-governing Colonial Empire and Newfoundland).
(†) Depending upon current rate of exchange.

This table, excerpted from data compiled by Chase National Bank, gives essential import requirements for countries of major importance in the market before the war. Due to the rapidly changing situation present figures are unavailable

The same principle applies to the design of the product. Exporting can not be carried on on the dumping principle that if the goods can not be sold in this country, they can literally be kicked off the continental shelf into the sea to be picked up by goods hungry importing firms and adapted as well as possible to local conditions, problems and desires.

Much thought must be given to the requirements of the foreign market at the time an exportable piece of apparatus is designed so that it can be used when sold. In this connection it may be noted that the only important voltages and frequencies for which it is necessary to provide are 110 volts, 50 and 42 cycles, 220 volts 50 and 60 cycles and 230 volts 50 cycles. There are some others but they are not of sufficient commercial importance to justify design modifications. However at the time the original design for the American market is put on tracing cloth, it is no trick at all to inscribe on the vellum the necessary motor, transformer and resistance changes to make it possible later for specials for the export trade to come off the production line without the application of new engineering time.

Taste and custom in foreign countries also should receive con-

(*Continued on page* 126)

MARKETING – Now the Twin

By MILLARD H. NEWTON*

An outline of basic factors in the next phase of the electronic industry

● At the very outset, let us get ourselves properly oriented for a 1946 view of electronic marketing. Try to keep away from economics, politics and other unfathomable factors in marketing. Recall that economics alone, or politics alone, never stopped the sale of a much-needed article. Labor, recently, has been more successful in doing so, but that's another story.

In 1932, when 4,500 banks were closed and ready cash was hard to get, selling continued at a furious pace in many lines. In one way or another, the buyer managed to buy what he was determined to get, provided the article was in production. However, shortages such as we have today were not the style during the bank moratorium.

Market planning essential

Assuming that the major obstacles of the radio-electronic industry will be removed or minimized shortly and that reconversion is waiting for its second wind, we will soon find the industry diving into the dual phase of production and marketing. But can we be sure that the two will be well planned and coordinated in the best traditions of marketing?

Probably not, if past experience in radio is any indication. Scant attention will be given to the grim lessons of earlier years when many good companies with well-engineered products went to the wall—not through any lack of engineering genius but through a weird misjudging of markets and marketing methods.

Most frequent among the explanations for receiverships, reorganizations and control by creditors, has been the plea of overproduction. In most cases, production was planned with great precision in cost, quality and volume but, as usual, the marketing function was handicapped by strange mixtures of poor market estimates, wishfulness in planning and often faulty sales policies.

Such maltreatment of a vital sales function is hardly excusable; yet, on behalf of the electronic industry it must be acknowledged that there are no beaten paths; no clearly established policies, no well-defined channels of distribution.

Helps and hindrances

It must be recognized that war and war production are also partly responsible. They have expanded productive capacity and widened electronic markets without contributing anything to marketing machinery, methods or knowledge. This explanation, however, cannot long condone a lack of marketing yardsticks, a failure to do creative planning or a neglect to coordinate production and marketing.

Nor is there much point to the contention that the electronic industry has a specialized apparatus market; that it is different from radio receiver merchandising and other fields where standardized units are sold by the million. In some older industries that never have had anything else but an apparatus market, their products have had the benefit of sound planning, plus much originality and pioneering. Product designs, output, sales policies, distributing methods and promotion plans have been based on market studies and all have been keyed together for the final purpose of marketing.

Basic principles needed

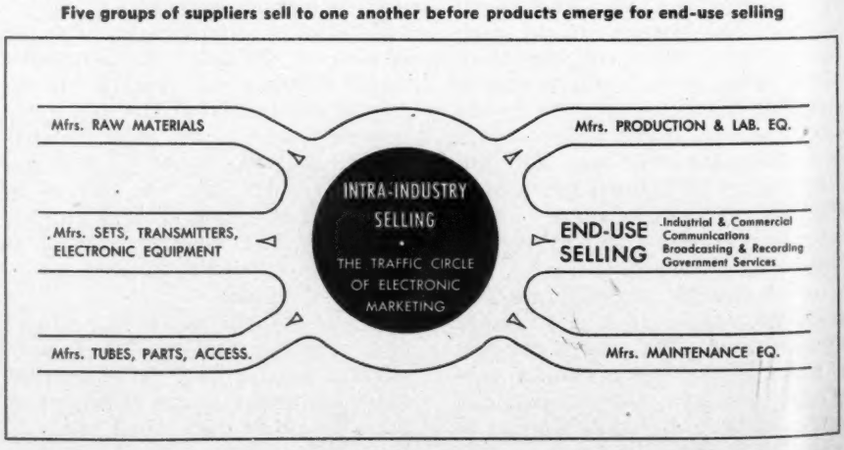
If we concede that marketing is the ultimate goal of all manufacturing and if we admit that the electronic industry is fundamentally an engineering business, there are several premises that could well be adopted as a preliminary to any marketing plan in this field.

1—Recognize that marketing is an indispensable part of any project; that it requires (and is worthy of) equal exactness in plan, method, facilities, personnel and execution.

2—Encourage the engineer to concern himself with marketing considerations in every move from the inception of the original idea to its eventual promotion by the advertising department and its use by the customer.

3—Retain the services of an advertising agency having a competent marketing research department and creative promotional ability.

Five groups of suppliers sell to one another before products emerge for end-use selling



*Marketing Counselor for Electronic Industries.

Problem With PRODUCTION

4—Gather all possible electronic marketing statistics and make sure that they are interpreted realistically.

5—Study the strengths and weaknesses of present marketing channels with an eye to the discovery of better ones.

6—Profit from the lessons learned in other fields where similar problems are found.

Marketing "kicked around"

Perhaps it will be said that these are old principles in a new dress; that no one disputes them. Yet they often get lost somewhere between the decision *what to make* and the natural impatience to start selling. Right there we have the first mistake in marketing—failure to adopt basic principles and stick to them. The above suggestions are six of the tenets that apply to all manufacturers in this field regardless of their special problems or circumstances. Through them we find out *where* and *how* to do our selling—something that should certainly precede any manufacturing program.

Now, while all manufacturers have certain principles in common, they are not all alike in their needs and methods. There may not be any relation between the sales work of a manufacturer who turns out a simple packaged item and another manufacturer who custom-builds a piece of industrial or communication equipment costing $10,000.

Between these extremes there is a great variety of marketing requirements that each manufacturer much approach from the standpoint of his own individual situation but only *after* he has determined what that situation really is—again illustrating the importance of the utmost familiarity with the market in terms of size, location and peculiarities in buying habits.

To cite another contrast, there is not a great deal in common between the manufacturer of parts who wants to get the bulk of his volume by supplying the needs of a few big set builders, and the manufacturer of laboratory or test equipment who hopes to sell *all* of the set builders and other groups, too.

Standard items vs. specialties

Those who make standard items for original equipment may not have a serious problem in market determination. All of the customers are known and quotations are based on definite quantities. Their principal problem is likely to be the selling of that market against stiff price competition.

The manufacturer who goes after the communications or industrial market usually has it departmentized and operated by specialists. The prospects may be engaged in general industry, in broadcasting, marine, aircraft, police, railroad communication, etc. The sales department is up against the extreme in selective selling — diversified fields, widely scattered locations, specialized designs, high selling cost and the necessity of frequent customer contact.

On the other hand, items such as photoelectric cells and relays, or complete units containing them, can be sold to a certain extent through electronic parts distributors. Nevertheless, the enterprising manufacturer will maintain engineering offices or Representatives who are engineers, in scores of cities. They will counsel the customer, steer him to the local distributor, direct him to the factory or even take the order on the spot.

The IRE "bee hive"

An excellent illustration of the complex and divergent methods used in electronic marketing was found in the last Midwinter meeting of the IRE in New York, where intra-industry marketing was seen at work. Engineer-salesmen of one

(*Continued on page* 132)

A Quiz to Emphasize Some of the Critical Differences in Marketing Plans

PRODUCT

- Is the need recognized or must it be created?
- Has the product any outstanding advantage over competing products?
- Can competitors match delivery, performance and price?
- What would you do if your strongest competitor surprised the field with a major improvement?

COMPANY AIMS

- Has a marketing goal been fixed?
- How do you know that the objective is reasonable and realizable?
- What is the greatest element of chance involved?
- Does the plan differentiate between the methods needed in marketing standard products and those needed in building to specifications?
- Has company strength been impaired by labor and price troubles?
- Is the company placing too much reliance on previous prestige?

MARKET

- Should a special market analysis be made?
- What data are needed and where obtainable?
- What share of the market can be expected?
- What is the alternative if buyers do not ask you to quote or bid?
- Is your marketing disturbed by federal price controls?
- Is the market menaced by government surplus selling?
- Will the replacement market ultimately exceed the initial market?

TYPE OF DISTRIBUTION

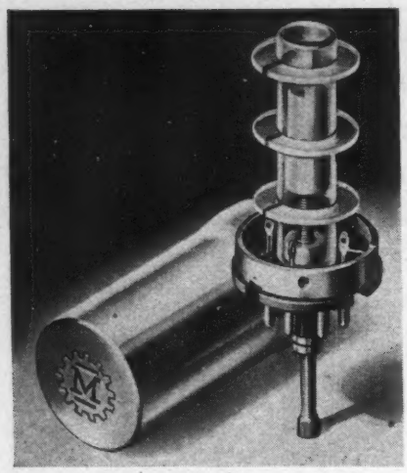
- Does the nature of the product dictate the type of distribution needed?
- Is the type of distribution influenced by the necessary qualifications or training of local personnel?
- Does the sales work require technical assistance to the customers?
- Can competitive distribution become superior?
- Local facilities needed?—office, display room, branch, warehouse, etc.?

PROMOTION

- How can the product best be promoted?
- How should the advertising appropriation be determined?
- Can a comprehensive prospect list be compiled?
- Can new uses for the product be found?

WHAT'S NEW—CHICAGO

Devices, products and materials seen at the Parts and Equipment Show



Tunable Coil Form

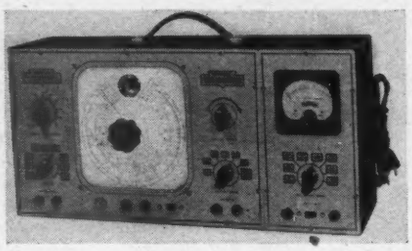
In addition to its pre-war products, which are now again available, the James Millen Mfg. Co., 150 Exchange St., Malden, Mass., has developed a series of "Designed for application" products, such as a 2 in. oscilloscope, transmitting condensers and a tunable coil form. The plug-in coil form is permeability tuned and suitable for use up to 35 mc.—Electronic Industries

Photo-Flash Capacitor

A capacitor having high energy storage and small size for super-speed photo-flash work has been developed by Tobe Deutschmann Corp., Canton, Mass. The unit has a storage capacity of 100 watt-seconds at a peak rating of 2500 volts dc and is especially designed for portable speed-flash units for indoor and outdoor service. Performance tests indicate an expected life of at least 10,000 charge-discharge cycles at peak rating.—Electronic Industries

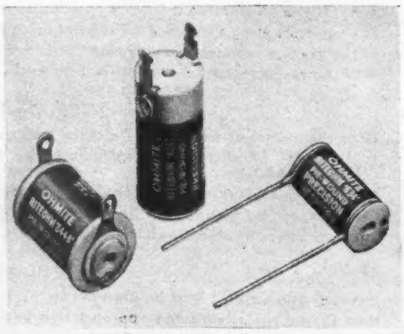
Portable Induction Solderer

Marion Electrical Instrument Co., Stark Street Gate, Manchester, N. H., has a portable induction soldering unit consisting of a self-excited rf power oscillator operating at 450 kc. It consumes approximately 775 watts for full power output at 115 v., 60 cycles ac.—Electronic Industries



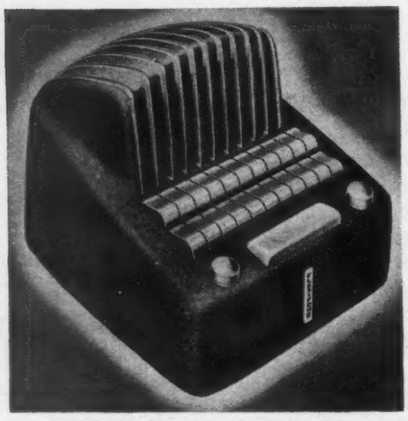
Test Unit

A new model of the Tel-Ohmike retains the features of the previous unit but in addition now includes a dc volt-milliammeter. The meter will measure voltages up to 1,500 v dc, and currents to 50 ma dc. Capacities between 0.000010 to 2,000 mfd and dc resistance values up to 5 megohms can be checked. Power factor and leakage currents are read directly. Made by Sprague Products Co., North Adams, Mass.—Electronic Industries



Precision Resistors

Series 82, 83 and 84 Riteohm precision resistors are being exhibited by Ohmite Mfg. Co., 4835 Flournoy St., Chicago 44, Ill. These three series are pie-wound to 1% accuracy. Vacuum impregnation with a special varnish provides insulation and protection against humidity.—Electronic Industries



Intercom System

Operadio Mfg. Co., St. Charles, Ill., has developed the "Flexiphone" intercommunications system consisting of a master station and six, ten or twenty remote stations. The equipment is housed in a functionally styled die-cast metal casing and uses a piano type keyboard as station selector. — Electronic Industries

Electronic Switch

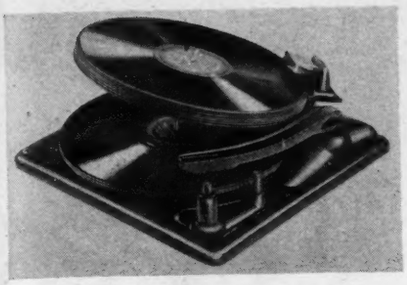
A new electronic switch designed for special electrical studies of wave form, phase, frequency relationship and amplitude comparisons is being made by the Electronics Dept., General Electric Co., Syracuse, N. Y. Operating on any sweep frequency of from 10 cps to 12,000 cps, continuously variable, it has an amplifier frequency response of 4 cps to 450 kc flat within 3 db.—Electronic Industries

Comparison Bridge

For precision and production testing of resistors, capacitors and inductors Freed Transformer Co., 72 Spring St., New York 12, has designed the No. 1010 comparison and limit bridge. The unit is operated from the ac power line and has three testing frequencies available: 50 or 60 cps. taken from the line, 1000 and 10,000 cps. generated by an oscillator. The percentage difference between the unknown and the standard can be read of on two ranges, a 10% range and a 20% range.—Electronic Industries

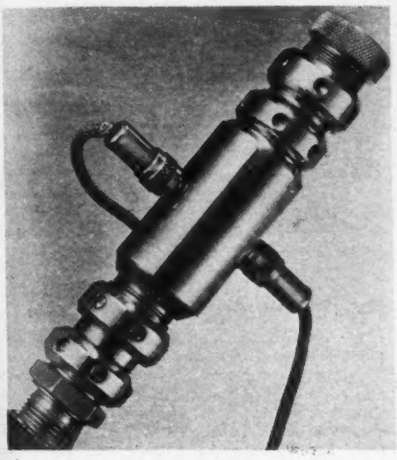
Vacuum Tubes

A miniature gas-filled phototube using a S3 photosurface is a new development of National Union Radio Corp., 15 Washington St., Newark 2, N. J. Other miniature tube types are rectifiers, amplifiers and converters. Also shown is an ionization gage tube a UHF power triode, a microwave coaxial triode, a magnetically focused radia beam tube and for television set testing, a 5 in. picture signal generator.—Electronic Industries



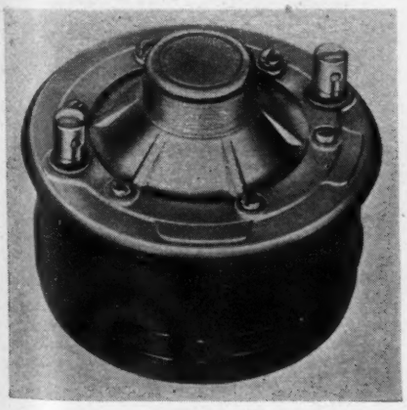
Record Changer

Webster Chicago, 5610 Bloomingdale Ave., Chicago, has a series of record changers, among them the model 56, which was originally developed for the armed forces. The changer accommodates twelve 10 in. or ten 12 in. records at one loading and has a fast change cycle of approximately 4 seconds. Automatic shut-off after the last record is provided.—Electronic Industries



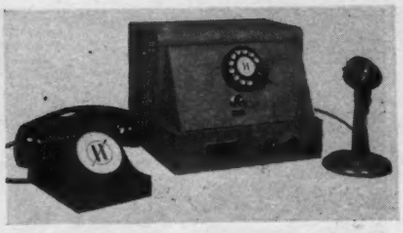
Pressure Measurement

Static and dynamic pressures in enclosed chambers can be measured electronically by a new unit developed by Electro Products Laboratories, 549 W. Randolph St., Chicago 6, Ill. Pressure variations are observed on either a cathode-ray or direct writing oscillograph. A wide range of interchangeable diaphragms and mountings is available. —Electronic Industries



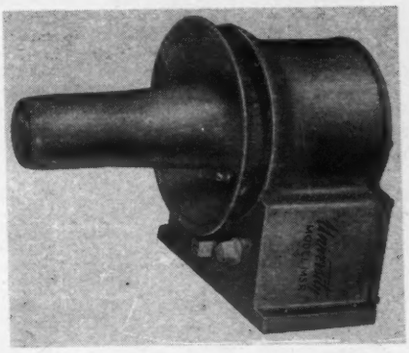
Reproducer Unit

Hermetically sealed, new design driver type reproducers are being made by Atlas Sound Corp., 1443 39th St., Brooklyn 18, N. Y. These units use a new laminated phenolic diaphragm with all parts bonded together by thermo-setting cement. Will handle 25 w of input power. The response is 80 to 6,000 cycles, with an electro acoustic sensitivity of 181.—Electronic Industries



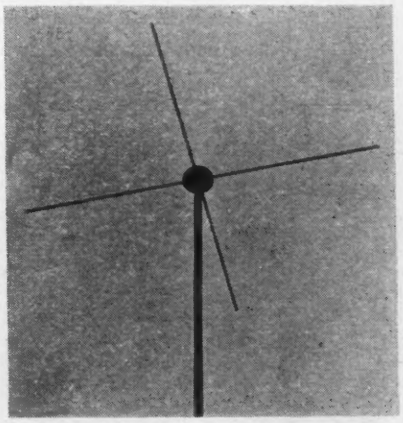
Dial Radio Telephone

A new selective signaling device which will select any one or group of desired stations for radio network communication has been developed by Hammarlund Mfg. Co., Inc,. 460 West 34th St., New York 1, N. Y. Called stations are connected and message starts in 3½ sec. Eighty-four stations or groups of stations can be handled with one signaling tone. New VHF-UHF variable capacitors using pyrex glass ball bearings are also displayed—Electronic Industries



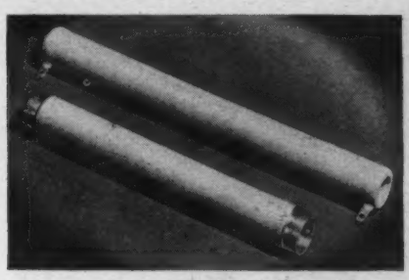
Marine Speaker

A submergence proof marine speaker of the radial reflex type with a non-directional 360° projection pattern has been developed by University Laboratories, 225 Varick St., New York 14. Used by the navy during the war, this speaker will operate under any condition of high humidity. It has a slightly rising frequency characteristic from 250 to 6000 cycles and a power handling capacity of 15 watts.—Electronic Industries



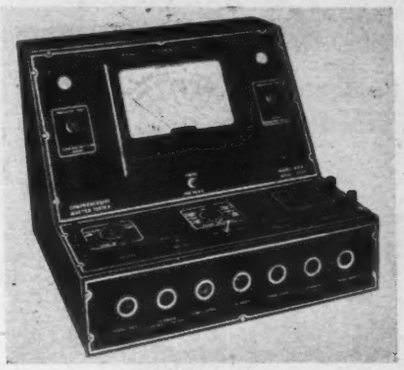
Dual-Purpose FM Antenna

The Workshop Associates, 66 Needham St., Newton Highlands, Mass., are exhibiting a dual-purpose FM antenna supplied in two kits. One provides elements for a non-directional FM antenna for rural listeners. A second kit will convert the non-directional antenna into a high-gain directional array by forming a dipole with reflector and director. Another interesting development is a new stand-off insulator for the 300 ohm parallel television lead-in line. The insulator is molded of weatherproof, plastic material and may be fastened with a single wood screw.—Electronic Industries



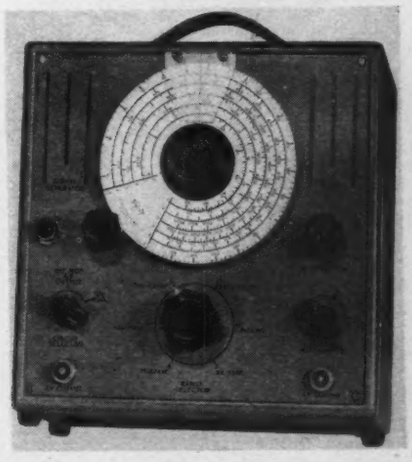
Enameled Resistors

Ward Leonard Electric Co., Mount Vernon, N. Y., is exhibiting Vitrohm "M" enameled resistors, which are capable of operating continuously at 275° C. They can be overloaded 10 times the rated value momentarily and will withstand over 9 cycles of salt water immersion. Available in ferrule, tab or screw terminal types, the units have a resistance tolerance of ±5% of specified values over 1 ohm.—Electronic Industries



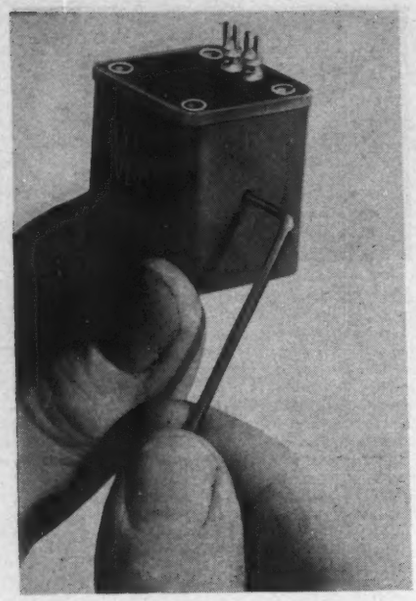
Multi-Tester

Laboratory and production testing may be handled on the master tester developed by Reiner Electronics Co., 152 W. 25th St., New York. Model 456 can be used as insulation tester, capacity meter, ohmmeter, ac and dc voltmeter, ac and dc ammeter, and as an impedance-inductance meter. The frequency range with special hf probe is up to 500 mc at an input capacity of 1 mmf.—Electronic Industries



Signal Generator

A signal generator covering the range from 75 kc to 50 mc in fundamental frequencies is one of the new products of Triplett Electrical Instrument Co., Bluffton, Ohio. Thirty per cent modulation at 400 cps is provided. Range selection is obtained by means of a six-position turret type coil switch. The instrument is voltage regulated at 115 volts, 50-60 cycles ac.—Electronic Industries



Variable Inductor

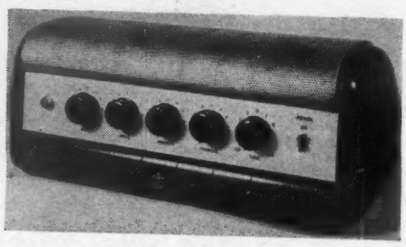
A tunable inductor for peaked amplifiers, filters, etc., has been developed by United Transformer Co., 150 Varick St., New York 13. Housed in a die-cast case, it weighs about 5 oz. The inductor permits a variation of inductance values from + 90% to — 50% by means of a set screw located on one of the sides.—Electronic Industries

Unidirectional Microphone

Using a supplementary phase shifting diaphragm, Electro-Voice, Inc., 1239 South Bend Ave., South Bend 24, Ind., has a new cardioid unidirectional crystal microphone. Sound from unwanted area is phase reversed, slowed up and neutralizes the sound pressure on the face of the actuating diaphragm. Sound sources in front of the microphone are fully reproduced. This model also has an adjustment for changing response from wide range substantially flat to wide range rising characteristic on the hf end.—Electronic Industries

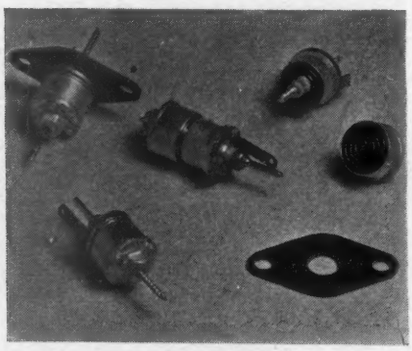
Multi-Tester

The model 424 volt-ohm-milliammeter made by the Radio City Products Co., 127 West 26th St., New York, has a three-inch meter with a sensitivity of 2500 ohms per volt and a movement of 400 microamperes. The ac-dc voltmeter sensitivity is 1000 ohms per volt. Voltage ranges up to 1000 volts, current ranges to 10 amperes and ohmmeter ranges to 10 megohms are provided. Db ranges are also incorporated.—Electronic Industries



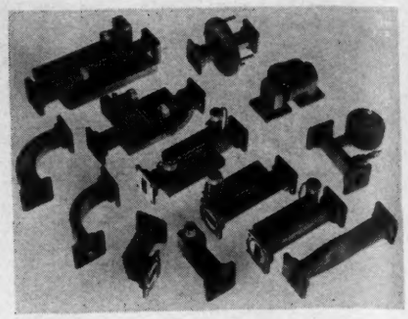
Packaged Sound

A 25-watt amplifier weighing 30 lbs. is a new development of RCA-Victor Division, Camden, N. J. These packaged sound kits are designed to provide low cost sound to classrooms, small night clubs, retail stores, etc. The line will include a complete line of microphones, amplifiers, speakers, baffles, horns, record players, disc recorders and portable sound systems.—Electronic Industries



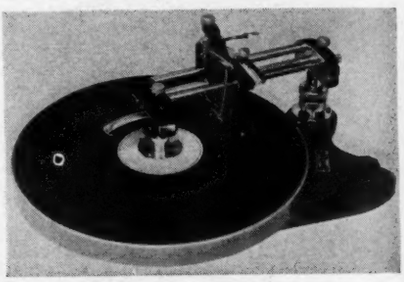
High-Q Trimmer Capacitors

An air-dielectric capacitor having unusually high "Q" up to 500 mc and possessing extraordinary mechanical and electrical stability has been developed by the Philips works in Holland. It is being distributed in America by the McMurdo Silver Co., Hartford, Conn. The trimmer range is 3-30 mmf with an insulation resistance above 10,000 megohms. The rotor position once set is permanent and independent of vibration.—Electronic Industries



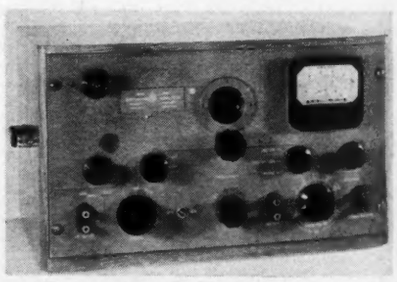
Microwave Components

In addition to the complete, packaged rf radar unit, DeMornay Budd, Inc., 475 Grand Concourse, New York 51, N. Y., are exhibiting standard wave guide components and test equipment. Frequencies covered are 4,000 to 9,600 mc in three bands and 23,000 to 27,000 mc.—Electronic Industries



Recording Equipment

Rek-O-Cut Co., 146 Grand St., New York 13, has a new "Master-Pro" recording unit. A slide mechanism on the cutter mount allows the operator to interchange the cutting head for most commercial makes of magnetic or crystal cutters. The standard feed screw cuts 120 lines per inch, but screws from 105 to 120 lines per in. outside-in or inside-out are available.—Electronic Industries



Distortion Analyzer

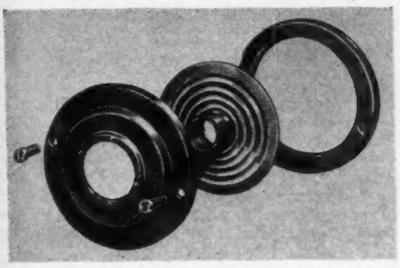
A distortion analyzer using resistance-tuned circuits in conjunction with an amplifier is being manufactured by Hewlett-Packard Inc., Palo Alto, Cal. Capable of measuring distortion at any frequency between 20 and 20,000 cps. with an accuracy of ± 3%, it permits measurements directly from a modulated rf carrier. Noise measurements as small as 100 microvolts may also be made. The instrument operates from a 115 v., 50-60 cycle ac power source and consumes 90 watts.—Electronic Industries

Varnish Insulation

A new varnish impregnant, Turbotuff, has such toughness that it resists cracking under almost any angle of bend or duration of twisting. This varnish has high stabilized dielectric values, greater resistance to elevated temperatures and a low moisture absorption factor. Made by William Brand and Co., 276 Fourth Ave., New York 10, N. Y.—Electronic Industries

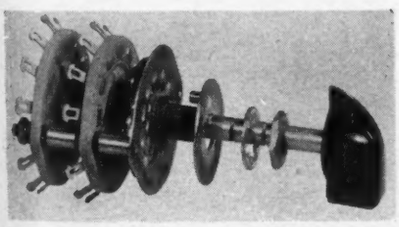
Communications Receiver

Covering a frequency range of 0.55 to 44 mc in four bands, the new model S-40 made by Hallicrafters Co., 2611 Indiana Ave., Chicago 16, Ill., has many features. Separate electrical bandspread with inertia flywheel tuning, temperature compensated hf oscillator, automatic noise limiter, beat frequency oscillator and separate rf and af gain controls help make this a versatile receiver. Normal positions of standard broadcast reception are designated in red on the tuning dial for family use.—Electronic Industries



PM Speakers

All cone reproducers now being made by Quam-Nichols Co., Cottage Grove Ave. & 33rd Place, Chicago, Ill., feature rim clamping of the cone. The spider is not glued or otherwise permanently fastened to the basket. Quick and accurate centering of the voice coil is accomplished by loosening two machine screws in the clamping ring assembly.—Electronic Industries

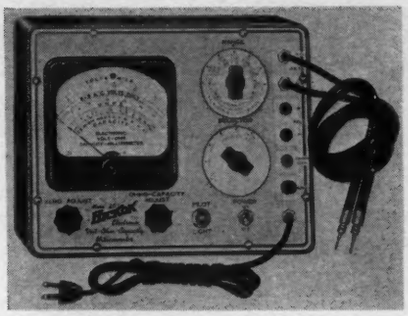


Selector Switch

A new ceramic insulated selection switch is being shown by P. R. Mallory & Co., Indianapolis 6, Ind. Developed for high frequency circuits, it has minimum rf losses and moisture absorption. Low resistance self-cleaning contacts are used. Unit combinations, ranging from one section with six positions to three sections with eleven positions, are available.—Electronic Industries

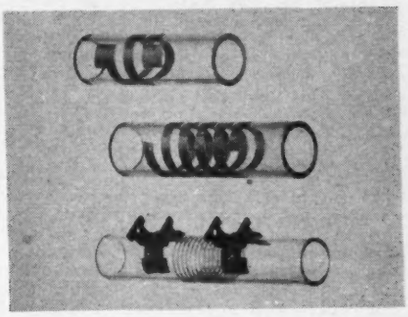
Miniature Tetrode

One of a complete series of miniature tubes, a new filamentary-type beam tetrode is now available for VHF mobile communications equipment. The 6 volt filament is instant-heating and eliminates standby current. Made by Hytron Radio & Electronics Corp., 76 Lafayette St., Salem, Mass., for transmitter use, this new 2E30 tube uses 250 v. on the plate and screen. Plate dissipation is 10 w. Hytron also has eleven new ac/dc miniatures especially designed for compact receiver and electronic equipment.—Electronic Industries



Volt-Ohm-Capacitance Milliammeter

A test instrument designed to accurately measure wide ranges of capacitance, resistance, ac and dc voltages and currents is being manufactured at Hickok Electrical Instrument Co., 10528 Dupont Ave., Cleveland 8, Ohio. The tester also provides for inductance measurements and is accurate up to 5 mc.—Electronic Industries

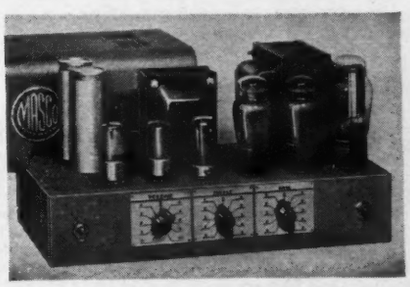


Metallized Glass

Corning Glass Works, Corning, N. Y., is showing many uses for metallized glass. Relay covers, instrument windows and various size glass tubes are provided for hermetically sealed enclosures. A simple soldering operation is used for sealing. Coil forms with metal tabs for regular coil winding or special metallized windings for high frequencies are available.—Electronic Industries

Automotive Antenna

ICA "Rocker," "Side-Cowl" and "Uni-Mount" car antennas are being displayed by the Insuline Corp. of America, Long Island City, N. Y. In addition precision made phone jacks of new design are exhibited. The spring-members are made of silver-plated phosphor bronze to minimize tension fatigue.—Electronic Industries



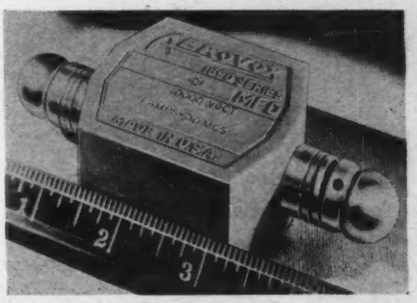
25 Watt Amplifier

Using 6L6 tubes in the output stage, a new high fidelity amplifier made by Mark Simpson Mfg. Co., 194 W. 4th St., New York 14, N. Y., has less than 5% RMS harmonic content. Gain is approximately 77 db with a frequency response between 30 and 15,000 cycles flat within plus or minus 1½ db. Either bass or treble attenuation or boost is possible without change of middle register response.—Electronic Industries

Sealed Resistors

Made with the same precision as their standard Tru-tolerance units, Madison Electrical Products Corp., 78 Main St., Madison, N. J., are now manufacturing a new hermetically sealed resistor. These components are permanently sealed with a ceramic to metal bond after all moisture is removed by a special process.

A rigid self-sustaining polystyrene air loop for the broadcast range is also new. Distributed capacity is 11 mmf. Loops can be wound to 300 "Q" and include a primary or short wave trap.—Electronic Industries

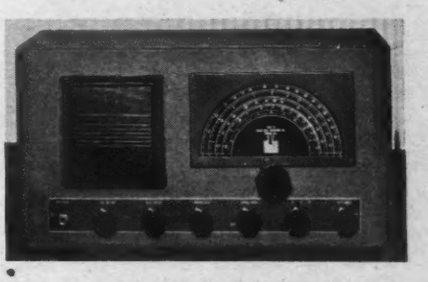


UHF Mica Capacitor

Designed for low-loss operation on ultra-high frequencies, series 1690 molded-in-bakelite mica capacitors developed by Aerovox Corp., New Bedford, Mass., have low rf impedance. All conducting members are silverplated to minimize skin resistance. Units are available in ratings up to 10,000 volts dc with capacitance values up to .001 mfd.—Electronic Industries

Play-back Needle

In addition to sapphire and ruby tipped needles, Duotone Co., Inc., 799 Broadway, New York City, is exhibiting a diamond tipped needle. Each unit is precision ground and the radius at the diamond tip is held to a tolerance of 0.0001 in. These diamond tipped needles were developed for broadcast use and the replaying of scarce "collector's item" records.—Electronic Industries

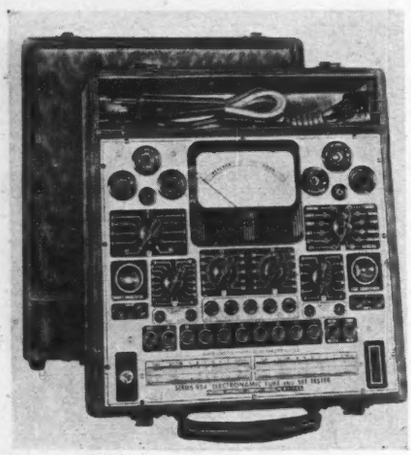


Communications Receiver

A communications receiver in the medium price class is being manufactured by Radio Mfg. Engineers, Inc., Peoria 6, Ill. The receiver has four tuning ranges, 540 kc to 44 mc., and bandspread scale, one stage of preselection, automatic noise limiter, stand-by switch and BFO switch control. It uses 8 tubes.—Electronic Industries

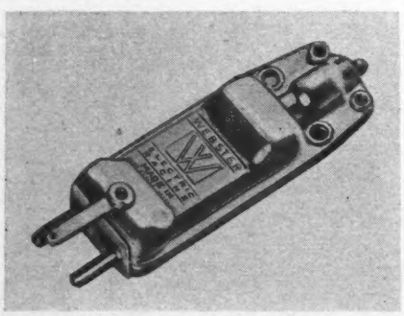
Spray Gun Kit

A felt flock kit including a hand operated air-spray gun provides a quick and durable surface for cabinet and equipment finishing. The flock particles are propelled at high velocity and embed themselves in a previously applied undercoat. Made by Walter L. Schott Co., Beverly Hills, Cal., this type of finish is available in 8 colors.—Electronic Industries



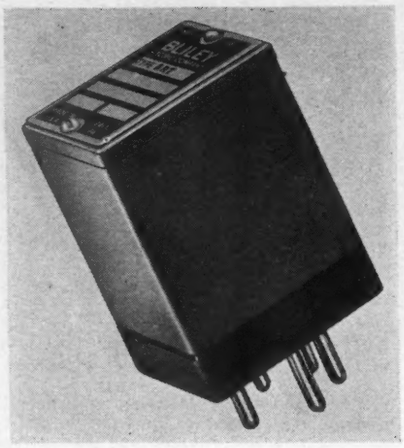
Tube and Set Tester

With a convenient layout of control dials and switches, the Series 954 tube and set tester made by Precision Apparatus Co., Elmhurst, L. I., N. Y., is especially designed for use in both bench production and portable testing. Meter sensitivity is 20,000 ohms per volt dc and reads up to 6,000 volts.—Electronic Industries



Pick-up Cartridges

The new crystal pick-up cartridges being shown by Webster Electric Co., Racine, Wis., are made in a wide range of varied mechanical and electrical characteristics. The units are cased in either stamped brass or aluminum halfshells or die-cast aluminum and zinc halfshells. Some models are designed for sharp cut-off at the high frequencies, others have an exceptionally wide-range response and one unit has a high voltage output for use with low-gain amplification record-playing equipment.—Electronic Industries



Crystal Unit

Engineered for service in the VHF bands, a new crystal unit with built-in heater is being shown by Bliley Electric Co., Erie, Pa. It is available for all frequencies from 3,500 to 11,000 kc. Efficient frequency multiplication can be obtained by the use of a tuned screen, tuned plate oscillator circuit. The built-in heater permits over-all frequency tolerances of 0.005% plus or minus. —Electronic Industries

Record Changers

Three models of phonograph record changers are being shown by V-M Corp., Benton Harbor, Mich., each using a different type of release mechanism. One unit is completely jam-proof and will play 10 and 12 in. records intermixed. Cycling time from one record to the next is less than 4 sec. A new type of tone arm eliminates distortion and resonance. — Electronic Industries

Metal Film Resistor

A new resistor, having the accuracy of a wire wound unit, but using a metal film, has been developed by Continental Carbon Inc., 13900 Lorain Ave., Cleveland 11, Ohio. No carbon is used in these components, the metallic resistance film being formed on the surface of a low loss ceramic tube by a patented pyrochemic process. Low noise and high resistance stability are characteristics of this new resistor.—Electronic Industries

Tube Adapters

An additional line of "Sockette" radio tube adapters to be used in conjunction with miniature tubes has been bought by J.F.D. Mfg. Co., 4109-4123 Ft. Hamilton Parkway, Brooklyn 19, N. Y. The adapters permit the substitution of available miniature tubes for hard-to-get or unobtainable standard tube types. Thirty-five adapters suitable for most popular tube types are available.—Electronic Industries

Automobile Aerials

New models of automobile aerials are being displayed by Radiart Corp., 3571 West 62nd St., Cleveland 2, Ohio. The de luxe types include rods made of antimonial admiralty brass with a static muffler ball on top. Fittings and mounts are provided for correct installations on car. Other features are all metal anti-rattlers and plasti-loom leads.—Electronic Industries

Phono-P.A. System

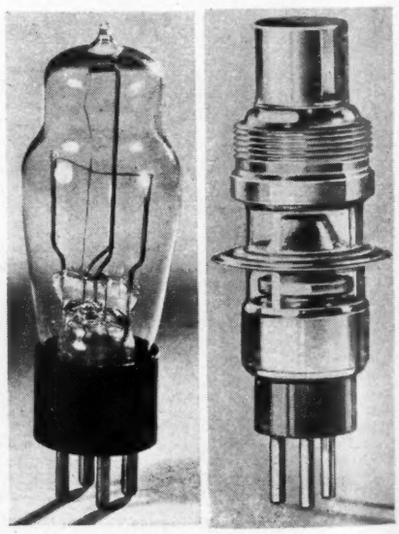
Designed for high quality sound coverage with compact portability, a new 25 watt phonograph-public address combination is being made by Bell Sound Systems, Inc., 1183 Essex Ave., Columbus 3, Ohio. The dual speed turntable will take up to 16 in. transcriptions. Individual bass, treble and volume controls are provided. The speaker is a 12 in. PM heavy duty unit.—Electronic Industries

Car Antenna

An automobile antenna for mounting in either top cowl or top fender positions is being made by Rad-El-Co. Mfg. Co., 6300 Euclid Ave., Cleveland 3, Ohio. The mast is adjustable through a 25° angle in any direction. The radar-type lead cable uses poly-ethylenne as an insulator. "Q" is higher than 500 and the capacity is less than 1 mmf per inch.—Electronic Industries

Thermocouple Tube

A thermocouple tube for direct microammeter measurement of vacuum and low gas pressures has been designed by Sylvania Electric Products, Electronics Div. Boston 15, Mass. Pressures of 10^{-1} to 10^{-5} mm can be recorded with an accuracy of plus or minus 5%. Operating on a 3-volt battery and resistance circuit the tube has a filament resistance of 3 ohms, thermocouple resistance 5 ohms, filament current 125 ma. and thermocouple current 250 microamps.—Electronic Industries. Below, left.



Reflex Klyston

A new reflex klyston designed for operation at wavelength between 6 and 7 cm has been developed by the Research Laboratories of Sylvania Electric Products, Inc., Flushing, N. Y., and will be shown in Chicago. The tube design features "quick change" by means of a threaded disc-seal electrode. 70 milliwatts output at 7.0 cm.—Electronic Industries. Above, right.

RADIO STATIONS

A directory of Standard AM, FM and Television broadcast stations with their chief engineers

STANDARD BROADCAST

ALABAMA

Radio Station and Address	Chief Engineer
WHMA—14th & Noble, Anniston	J. Hudson
WJLD—1800 3rd N., Bessemer	Rufus Jones, Jr.
WAPI—Protec. Life Bldg., Birmingham	N. S. Hurley
WBRC—2nd at 18th, Birmingham	G. P. Hamann
WSGN—Box 2553, Birmingham	Gordon F. Bishop
WMSL—511 Bank, Decatur	J. V. Roser
WAGF—204½ E. Amin, Dothan	J. T. Hubbard
WJBY—108 Broad, Gadsden	Wm. Pigg
WBHP—318 W. Clinton, Huntsville	John Garrison
WALA—106 St. Joseph, Mobile	R. B. Hurley
WMOB—600 St. Louis, Mobile	T. L. Greenwood
WCOV—Exchange Hotel, Montgomery	W. D. Weatherly
WSFA—Jefferson Davis Hotel, Montgomery	C. Shelkofsky
WLAY—Box 230, Muscle Shoals	Lynn V. McMoran
WJHO—1400 Auburn, Opelika	John B. Venters
WHBB—209 Washington, Selma	Thos. F. Kelly, Jr.
WFEB—527 N. B'way, Sylacauga	J. S. Stowers, Jr.
WHTB—122 S. Court, Talladega	Julius C. Vessels
WJRD—First Nat'l Bank, Tuscaloosa	J. W. Arendale

ARIZONA

KWJB—Globe	Herbert Hartman
KSUN—Bisbee Sta., Lowell	Wm. Scharlach
KOY—836 N. Central, Phoenix	J. L. Sublett
KPHO—Adams Hotel, Phoenix	Louis Halpern
KTAR—711 Heard Bldg., Phoenix	Arthur C. Anderson
KYCA—E. Gurley, Prescott	Geo. Eitel
KGLU—Safford	H. Hartman
KTUC—900 E. B'way, Tucson	Clifford Livingston
KVOA—Tucson	Ray H. Holsclaw
KYUM—1901 1st, Yuma	L. Wheeler

ARKANSAS

KLCN—Hotel Noble, Blytheville	R. Conner
KELD—Country Club, El Dorado	A. W. Hearin
KFPW—1213 Garrison, Ft. Smith	J. M. Van Horn
KFFA—215 York, Helena	A. P. Decker
KTHS—135 Benton, Hot Springs	Cecil Suitt
KWFC—Hot Springs	Earl Butler
KBTM—Jonesboro	J. E. Hitt
KARK—112 E. Capitol, Little Rock	Dan Winn
KGHI—Union Life Bldg., Little Rock	B. Vandusen
KLRA—Gazette Bldg., Little Rock	K. F. Tracy
KOTN—505½ Main, Pine Bluff	B. J. Parrish
KUOA—Siloam Springs	Kenneth Maxwell

CALIFORNIA

KERN—Elks Club Bldg., Bakersfield	L. E. Shatto
KPMC—Box 1709, Bakersfield	L. P. Jarvis
KRE—601 Ashby, Berkeley	P. C. McKernan
KHSL—336 B'way, Chico	R. Pope
KXO—Box 140, El Centro	L. Bellwood
KIEM—Box 1021, Eureka	A. E. Olson
KARM—1333 Van Ness, Fresno	R. M. Dorothy
KFRE—Patterson Bldg., Fresno	H. R. Brown
KMJ—1559 Van Ness, Fresno	Wm. Wallace
KIEV—102 N. Glendale, Glendale	V. Schumann
KFOX—220 E. Anaheim, Long Beach	L. W. McDowell
KGER—435 Pine, Long Beach	R. Oakley
KECA—1440 N. Highland, Los Angeles	T. B. Palmer
KFAC—645 S. Mariposa, Los Angeles	Calvin J. Smith
KFI—141 N. Vt., Los Ang.	C. W. Mason, H. L. Blatterman
KFSG—1100 Glendale, Los Angeles	C. H. Haas
KFVD—338 S. Western, Los Angeles	J. Fredericks
KFWB—5833 Fernwood, Hollywood	H. Myers
KGFJ—6314 Sunset, Hollywood	H. Obuchon
KHJ—5515 Melrose, Los Angeles	F. M. Kennedy
KMPC—5939 Sunset, Hollywood	L. C. Sigmon
KNX—6121 Sunset, Los Angeles	L. H. Bowman
KRKD—541 S. Spring, Los Angeles	W. O. Freitag
KMYC—Box 631, Marysville	J. D. Carroll
KYOS—Box 717, Merced	Malcolm R. Beavers
KTRB—Box 593, Modesto	W. H. Bates, Jr.
KDON—273 Pearl, Monterey	Omer N. Wright
KLX—13 & Franklin, Oakland	Roswell Smith
KROW—Radio Center Bldg., Oakland	C. E. Downey
KWBR—327 21st, Oakland	F. Wellington Morse
KCMJ—Box KK, Palm Springs	Donald C. McBain
KXLA—1401 S. Oak Knoll, Pasadena	J. Reeder
KPPC—585 E. Colorado, Pasadena	N. V. Parsons
KWKW—425 E. Green, Pasadena	P. Spargo
KVCV—Redding	Russ Pope
KPRO—3401 Russell, Riverside	S. Reynolds
KCRA—10th & Jay, Sacramento	M. D. Myers
KFBK—708 Eye, Sacramento	Stam Sronce
KROY—Hotel Sacramento, Sacramento	H. Martineau
KXOA—1617 30th, Sacramento	H. N. Black
KFXM—512 5th, San Bernardino	Geo. W. Ewing
KFMB—1375 Pacific, San Diego	Caleb Frisk
KFSD—326 B'way, San Diego	R. L. Gartner
KGB—1017 1st, San Diego	Wm. G. Collins
KFRC—1000 Van Ness, San Francisco	J. J. McArdle
KGO—420 Taylor, San Francisco	A. E. Evans
KJBS—1470 Pine, San Francisco	Wm. Nielson
KPO—Taylor & O'Farrell, San Francisco	Curtis D. Peck
KSAN—1355 Market, San Francisco	N. J. Patterson
KSFO—Hopkins Hotel, San Francisco	Royal V. Howard
KYA—Hearst Bldg., San Francisco	Paul C. Schulz
KQW—89 E. San Antonio, San Jose	Kenneth Owen
KVEC—Mt. View & Hill, San Luis Obispo	Earle Travis
KVOE—206 N. Main, Santa Ana	Wallace S. Wiggins
KDB—1309 State, Santa Barbara	Wm. C. Buckley
KTMS—Guerra Plaza, Santa Barbara	A. Nicolay
KSRO—425 Mendocino, Santa Rosa	H. S. McCauley
KGDM—517 E. Market, Stockton	M. B. Greene
KWG—Hotel Wolf, Stockton	Russell Bennett
KCOK—Box 873, Tulare	Sheldon Anderson
KTKC—Box 511, Visalia	Bert Williamson
KHUB—Atkinson Lane, Watsonville	Geo. F. Kenville

COLORADO

KGIW—Alamosa	Geo. Kettle
KVOR—Antlers Hotel, Colorado Springs	H. C. Strang
KEFL—Albany Hotel, Denver	Tom Atherstone
KLZ—Shirley-Savoy Hotel, Denver	H. Wehrman
KMYR—1626 Stout, Denver	Glen James
KOA—1625 California, Denver	R. H. Owen
KPOF—1845 Champa, Denver	Paul H. Schissler
KVOD—Midland Savings Bldg., Denver	Wm. D. Pyle
KIUP—2800 Main, Durango	John L. Antic
KFXJ—Box 30, Grand Junction	D. E. Towne
KFKA—620 8th, Greeley	Ray E. Smith
KOKO—La Junta	L. E. Wilson
KGHF—304 N. Main, Pueblo	Willis C. Shanks
KGEK—Fleming Rd., Sterling	E. G. Beehler

CONNECTICUT

WICC—Stratfield Hotel, Bridgeport	Geo. Keich
WNAB—991 Broad, Bridgeport	V. DeLaurentis
WDRC—750 Main, Hartford	Italo Martino
WHTD—54 Pratt, Hartford	Rogers B. Holt
WTHT—555 Asylum, Hartford	Chas. S. Masini
WTIC—26 Grove, Hartford	H. D. Taylor
WELI—221 Orange, New Haven	Fred King
WHNC—1110 Chapel, New Haven	V. DeLaurentis
WNLC—281 State, New London	Gerald J. Morey
WSTC—270 Atlantic, Stamford	Edward L. Markman
WATR—71 Grand, Waterbury	Harold Thomas
WBRY—136 Grand, Waterbury	F. B. Hales

DELAWARE

WDEL—10th & King, Wilmington	J. E. Mathiot

DISTRICT OF COLUMBIA

WINX—8th & Eye N. W., Washington	Ralph E. Cannon, Jr.
WMAL—724 14th N. W., Washington	Dan Hunter
WOL—1627 K, N. W., Washington	Harold Reed
WRC—724 14th N. W., Washington	A. E. Johnson
WTOP—Earle Bldg., Washington	Clyde M. Hunt
WWDC—1000 Conn. N. W., Washington	Ross H. Beville

FLORIDA

WMFJ—126 Magnolia, Daytona Beach	W. Wright Esch
WINK—54 E. 1st, Fort Myers	F. A. Scott
WRUF—Gainesville	Palmer H. Craig
WJAX—1 Broadcast, Jacksonville	John T. Hopkins III
WJHP—500 Laura, Jacksonville	B. Hayford
WMBR—118 W. Adams, Jacksonville	E. B. Vordermark
WPDQ—Gulf Life Bldg., Jacksonville	Jas. R. Donovan
WKWF—Stock Island, Key West	H. G. Scholz
WLAK—Box 1211, Lakeland	Wm. P. Lee
WGBS—1605 Biscayne, Miami	Ernie Johnson
WIOD—600 Biscayne, Miami	M. C. Scott, Jr.
WQAM—Box 3741, Miami	Earl W. Lewis
WKAT—1759 Bay Rd., Miami Beach	Arthur P. Smith
WTMC—1 Broadcast, Ocala	Don Richardson
WDBO—563 N. Orange, Orlando	J. E. Yarbrough
WWPG—So. Ocean, Palm Beach	Clyde L. Walkden
WDLP—Beach Drive & Mercer, Panama City	Elmer Scott
WCOA—Box 1669, Pensacola	Bert Mead
WFOY—F't'n of Youth Pk., St. Augustine	John E. Bernhard
WSUN—Box 240, St. Petersburg	Louis J. Link
WTSP—Times Bldg., St. Petersburg	Wm. D. Mangold
WSPB—Box 1110, Sarasota	James E. Grant
WTAL—Box 989, Tallahassee	Wm. A. Snowden
WDAE—112 N. Franklin, Tampa	W. P. Moore
WFLA—Seminole Bldg., Tampa	Jos. H. Mitchell
WJNO—1500 N. Flagler, W. Palm Beach	Otis C. Wright

GEORGIA

WALB—Albany Theatre Arcade Bldg., Albany	B. Alford
WGPC—127½ N. Jackson, Albany	Albert Timms
WGAU—Bobbin Mill, Athens	W. J. Evans
WAGA—Western Union Bldg., Atlanta	A. L. Brown
WATL—26 Cain N. W. Atlanta	A. P. Roberts
WGST—Forsyth Bldg., Atlanta	Ben Akerman
WSB—Biltmore Hotel, Atlanta	C. F. Daugherty
WGAC—Augusta	Jack Jopling
WRDW—8th & Broad, Augusta	H. Aderhold
WMOG—Brunswick	Kenneth E. White
WGAA—W. Theatre Bldg., Cedartown	Luther W. Martin
WDAK—1028 B'way, Columbus	DeForrest Layton, Jr.
WRBL—1420 2nd, Columbus	Jos. A. Gamble
WMJM—20th & B, Cordele	J. B. Broughton
WBLJ—111 S. Pentz, Dalton	J. S. Andrews
WMLT—Box 604, Dublin	J. B. Benonis
WGGA—Box 654, Gainesville	C. M. Callicott
WLAG—303 Broome, LaGrange	Jas. M. McKay
WBML—First Nat. Bank Bldg., Macon	H. S. Goodrich
WMAZ—Bankers Ins. Bldg., Macon	G. P. Rankin, Jr.
WNEX—Bibb Bildg., Macon	Ambrose Kibler
WMGA—Box 310, Moultrie	James M. Wilder
WRGA—Nat. City Bank Bldg., Rome	C. C. Williams
WSAV—Liberty Bank Bldg., Savannah	M. E. Thompson
WTOC—516 Abercorn, Savannah	Reeve Owen
WPAX—117 Remington, Thomasville	Jas. W. Poole
WRLC—Prather Bridge, Toccoa	R. R. Stoker, Jr.
WGOV—E. Park, Valdosta	L. C. McCall
WAYX—620 Plant, Waycross	J. J. Tobola
WRLD—Tyler Hotel, West Point	Dige Bishop

IDAHO

KIDO—Hotel Boise, Boise	Jas. Johntz
KID—Park & C, Idaho Falls	C. N. Layne
KRLC—Lewis-Clark Hotel, Lewiston	Gene Wilson
KFXD—1024 12th S., Nampa	E. P. Hurt
KSEI—Yellowstone Hwy., Pocatello	Henry H. Fletcher
KWAL—Tabor Bldg., Wallace	Howard G. Olsen

ILLINOIS

WMRO—34 S. River, Aurora	Phillip Olson
WJBC—209 E. Wash., Bloomington	James Hamm
WKRO—Cairo	Ralph L. Hirsch
WDWS—48 Main, Champaign	Jack R. Baum
WAAF—Palmer House, Chicago	Carl W. Ulrich
WAIT—360 N. Michigan, Chicago	E. W. Jacker
WBBM—410 N. Michigan, Chicago	J. F. Novy
WCFL—666 Lakeshore, Chicago	R. B. Pappin
WCRW—2756 Pine Grove, Chicago	Clinton R. White
WEDC—3860 Ogden, Chicago	C. T. Lewicki
WENR—Merchandise Mart, Chicago	E. C. Horstman
WGES—2708 W. Wash., Chicago	E. Plotts
WGN—441 N. Michigan, Chicago	G. Wm. Lang
WIND—230 N. Michigan, Chicago	K. C. Shirk
WJJD—230 N. Michigan, Chicago	W. F. Myers
WLS—1230 W. Wash., Chicago	Thomas L. Rowe
WMAQ—222 N. Bank, Chicago	H. C. Luttgens
WMBI—153 Institute, Chicago	A. P. Frye
WHFC—6138 W. Cermak, Cicero	Elmer P. Hayes
WDAN—Hotel Wolford, Danville	T. G. Magin
WSOY—351 N. Main, Decatur	Paul A. Wnorowski
WTMV—Broadview Hotel, E. St. Louis	Erle E. White
WGIL—Hill Arcade Bldg., Galesburg	Robert K. Pratt
WEBQ—100 E. Poplar, Harrisburg	Jos. R. Tate
WJPF—Box 179, Herrin	Gino Monaco
WLDS—Fox Bldg., Jacksonville	G. J. Cassens
WJOL—601 Walnut, Joliet	Robert Schmidt
WMBD—Alliance Life Bldg., Peoria	A. Jas. Ebel
WTAD—W.C.U. Bldg., Quincy	U. F. Whitman
WHBF—Safety Bldg., Rock Island	R. J. Sinnett
WROK—News Tower, Rockford	Wilfred A. Smith
WCBS—523 E. Capitol, Springfield	H. L. Dewing
WTAX—Reisch Bldg., Springfield	E. C. Swaringen
WDZ—McNeill Bldg., Tuscola	Ted Giles
WILL—1010 S. Wright, Urbana	John R. Brugger

INDIANA

WHBU—Citizens Bank Bldg., Anderson	L. F. Podhaski
WTRC—Hotel Elkhart, Elkhart	L. W. Zellmer

★ ELECTRONIC MARKETING

Radio Station and Address	Chief Engineer
WEOA—519 Vine, Evansville	J. B. Caraway, Jr.
WGBF—519 Vine, Evansville	J. B. Caraway, Jr.
WGL—201 W. Jefferson, Ft. Wayne	H. J. Beck
WOWO—925 S. Harrison, Ft. Wayne	Bruce H. Ratts
WJOB—449 State, Hammond	Stanley Strasburg
WFBM—48 Monument, Indianapolis	Harold S. Holland
WIBC—News Bldg., Indianapolis	Harry E. Adams
WIRE—Claypool Hotel, Indianapolis	E. E. Alden
WISH—Board of Trade, Indianapolis	Stokes Gresham, Jr.
WKMO—College Bldg., Kokomo	Geo. Palmer
WASK— Wallace Bldg., Lafayette	Harry C. Garba
WBAA—Hall of Music, Lafayete	Howard Eckert
WLBC—Box 271, Muncie	Maurice M. Crain
WKBV—25 S. 9th, Richmond	Louis Duning
WHOT—St. Joseph & Monroe, South Bend	Jack E. Willson
WSBT—225 W. Colfax, South Bend	Herbert G. Cole
WBOW—303 S. 6th, Terre Haute	Donald D. Aldrich
WAOV—320 Busseron, Vincennes	Eugene E. Alden

IOWA

WOI—Ames	L. L. Lewis
KBUR—National Bank Bldg., Burlington	John Gallino
WMT—Paramount Bldg., Cedar Rapids	Geo. P. Hixenbaugh
KROS—Jacobsen Bldg.; Clinton	Gilbert S. Andrew
WOC—1002 Brady, Davenport	P. G. Arvidson
KWLC—600 Leiv Ericksson, Decorah	Oliver Eittreim
KRNT—Register & Tribune, Des Moines	Chas. F. Quentin
KSO—800 Old Colony Bldg., Des Moines	F. E. Bartlett
WHO—914 Walnut, Des Moines	Paul A. Loyet
KDTH—8th & Bluff, Dubuque	Chas. Cain
WKBB—Hotel Julien, Dubuque	Leonard Carlson
KVFD—912 1st St., Ft. Dodge	Dave Sinclair
WSUI—Iowa City	S. J. Ebert
KFJB—1603 W. Main, Marshalltown	Jas. A. Dickens
KGLO—12 2nd N. E., Mason City	Leo W. Born
KBIZ—117 E. Main, Ottumwa	Geo. Caspers
KFNF—407 N. Sycamore, Shenandoah	R. N. Barkman
KMA—Lowell & Elm, Shenandoah	R. J. Schroeder
KSCJ—415 Douglas, Sioux City	Stephen C. Dier
KTRI—Commerce Bldg., Sioux City	Willard Easterly
KICD—Box 631, Spencer	Burney B. Jones
KXEL—Insurance Bldg., Waterloo	Don E. Kassner

KANSAS

KVAK—622½ Commercial, Atchison	Harry P. Elliott, Jr.
KGGF—Journal Bldg., Coffeyville	J. S. Jaminet
KGNO—705 2nd, Dodge City	Ralph Hickman
KTSW—613 Merchant, Emporia	Paul H. Daniels
KIUL—509½ N. Main, Garden City	Robert Snyder
KVGB—2103 Forest, Great Bend	Leo Legleiter
KWBW—101 E. Ave. A, Hutchinson	Millard H. Clary
WREN—Lawrence	C. B. Bliesner
KSAC—Manhattan	Bernard Holbert
KOAM—Box 603, Pittsburg	Leo Stafford
KSAL—Journal Bldg., Salina	N. E. Vance, Jr.
WIBW—1035 Topeka, Topeka	K. G. Marquardt
KANS—Wichita	Ted Heithecke
KFB—1st & Market, Wichita	K. W. Pyle
KFH—York Rite Bldg., Wichita	Amos Dadisman

KENTUCKY

WCMI—Box 949, Ashland	Clarence W. Weaver
WLBJ—Fairview & Lehman, Bowling Green	J. V. Pentacost
WHLN—S. Main, Harlan	J. Francke Fox
WSON—Box 418, Henderson	B. A. Smith
WHOP—Garnett Bldg., Hopkinsville	T. E. Brewer
WLAP—Radio Bldg., Lexington	Sanford Helt
WAVE—334 E. B'way, Louisville	Wilbur E. Hudson
WGRC—Kentucky Home Life Bldg., Louisville	P .W. Esten
WHAS—300 W. Liberty, Louisville	O. W. Towner
WINN—Tyler Hotel, Louisville	Elphin G. Rinn
WOMI—Owensboro	Leslie Goodaker
WPAD—Taylor Bldg., Paducah	U. C. Morris

LOUISIANA

KALB—505 Johnston, Alexandria	Jesse R. Sexton
WJBO—444 Florida, Baton Rouge	Donald K. Allan
KVOL—519 S. Buchanan, Lafayette	B. Hillman Bailey, Jr.
KPLC—Majestic Hotel, Lake Charles	Earl C. Moses
KMLB—Jackson & Harrison, Monroe	O. L. Morgan
KNOE—Box 1713, Monroe	E. R. Goodwin
WDSU—Hotel Monteleone, New Orleans	Chas. Whitney
WJBW—Audubon Bldg., New Orleans	Karl Seibold
WNOE—St. Charles Hotel, New Orleans	A. J. Bourgeois
WSMB—901 Canal, New Orleans	H. G. Nebe
WWL—Roosevelt Hotel, New Orleans	J. D. Bloom, Jr.
KTBS—Box 1121, Shreveport	C. H. Maddox
KRMD—Box 1712, Shreveport	Howard Hargrove
KWKH—Commercial Bldg., Shreveport	W. E. Antony

MAINE

WRDO—175 Water, Augusta	Harold Dinsmore
WABI—57 State, Bangor	Walter Dickson
WLBZ—100 Main, Bangor	John Wibby
WCOU—223 Lisbon, Lewiston	John T. Duty
WCSH—157 High, Portland	G. Fred Crandon
WGAN—645a Congress, Portland	Roger W. Hodgkins
WPOR—Portland	Roger Perry
WAGM—180 State, Presque Isle	L. E. Hughes

MARYLAND

WBAL—Lexington Bldg., Baltimore	R. Duncan
WCAO—811 W. Lanvale, Baltimore	Martin L. Jones
WCBM—No. & Hartford, Baltimore	G. Porter Houston
WFBR—10 E. North, Baltimore	Wm. Q. Ranft
WITH—7 E. Lexington, Baltimore	Jas. S. Duff
WTBO—31 Frederick, Cumberland	David Jefferies
WFMD—Winchester Hall, Frederick	Julius Thiel
WJEJ—Franklin Court, Hagerstown	Geo. McIntyre
WBOC—Radio Park, Salisbury	Peter A. Alfonsi

MASSACHUSETTS

WBZ—275 Tremont, Boston	W. H. Hauser
WCOP—Copley Plaza Hotel, Boston	Roland C. Hale
WEEI—182 Tremont, Boston	W. J. Stiles, Jr.
WHDH—62 Boylston, Boston	Philip K. Baldwin
WMEX—70 Brookline, Boston	John Memishian
WNAC—21 Brookline, Boston	I. B. Robinson
WORL—216 Tremont, Boston	J. W. Parker
WSAR—Academy Bldg., Fall River	John C. Pavao
WEIM—717 Main, Fitchburg	Ted Kalin
WHAI—354 Main, Greenfield	Jas. L. Spates
WHYN—180 High, Holyoke	T. R. Humphrey
WLAW—278 Essex, Lawrence	Geo. A. Hinckley
WLLH—39 Kearney, Lowell	A. Michaels
WNBH—588 Pleasant, New Bedford	Everett T. Parker
WBRK—8 Bank Row, Pittsfield	L. L. Lavendol
WESX—126 Washington, Salem	R. I. Hammond
WBZA—Springfield	W. H. Hauser
WMAS—1757 Main, Springfield	Earle Hewinson
WSPR—63 Chestnut, Springfield	L. A. Reilly
WOCB—So. Sea, West Yarmouth	Everett Parker
WAAB—34 Mechanic, Worcester	Joseph Grahn
WTAG—18 Franklin, Worcester	Elliot A. Browning

MICHIGAN

WPAG—Hutzel Bldg., Ann Arbor	Geo. D Stearns
WELL—Mich. Nat. Bank Bldg., Battle Creek	E. J. Stone
WBCM—Wenonah Hotel, Bay City	Ralph H. Carpenter
WATT—Box 219, Cadillac	Les Biederman
WHDF—Community Bldg., Calumet	Geo. L. Burgan
CKLW—Union Guardian Bldg., Detroit	W. J. Carter
WJBK—6559 Hamilton, Detroit	Paul Francke
WJLB—Eaton Tower, Detroit	Edward H. Clark
WJR—Fisher Bldg., Detroit	G. F. Leydorf
WWJ—630 W. Lafayette, Detroit	H. F. Tank
WXYZ—Stroh Bldg., Detroit	Chas. F. Kocher
WKAR—East Lansing	Norris E. Grover
WFDF—Mott Foundation Bldg., Flint	Frank D. Fallain
WJEF—Pantlind Hotel, Grand Rapids	Carl E. Lee
WLAV—6 Fountain N. E., Grand Rapids	Lee Stevens
WOOD—National Bank, Grand Rapids	C. F. Kocher
WJMS—124 E. McLeod, Ironwood	Arne Dahlbacka
WIBM—Hotel Hayes, Jackson	Chas. W. Wirtanen
WKZO—Burdick Hotel, Kalamazoo	Carl E. Lee
WJIM—Bank of Lansing, Lansing	Mel Wirth
WKLA—Stearns Bldg., Ludington	N. Hale Blakely
WKBZ—432 Apple, Muskegon	Geo. Krivitzky
WCAR—Riker Bldg., Pontiac	Wayne N. Cook
WHLS—932 Military, Port Huron	Leslie C. Conant
WEXL—212 W. 6th, Royal Oak	J. Steadley
WSAM—Eddy Bldg., Saginaw	Harold McCullen
WSOO—107 W. Portage, Sault Ste. Marie	Eugene Kaari
WTCM—Anderson Bldg., Traverse City	Les Biederman

MINNESOTA

KATE—332 S. Broadway, Albert Lea	Lawrence Lawson
KDAL—Bradley Bldg., Duluth	R. A. Dettman
WEBC—4th at Superior, Duluth	Wm. Lounsberry
KGDE—Fergus Falls	Milo Henry
WMFG—Androy Hotel, Hibbing	Wm. Lounsberry
KYSM—101 N. 2nd, Mankato	Jas. Houts
KSTP—St. Paul Hotel, Minneapolis-St. Paul	J. N. Fricker
KUOM—Eddy Hall, Minneapolis-St. Paul	B. A. Holmberg
WCCO—625 2nd S., Minneapolis-St. Paul	J. J. Beloungy
WDGY—Hotel Nicollet, Minneapolis-St. Paul	C. Winkler
WLOL—1730 Hennepin, Minneapolis-St. Paul	E. Plotts
WMIN—1287 St. Anthony, Minn.-St. Paul	W. B. Fritze
WTCN—Wesley Temple, Minn.-St. Paul	John M. Sherman
KVOX—Comstock Hotel, Moorhead	Harry Vose
WCAL—Northfield	M. C. Jensen
KROC—100 1st Ave. Bldg., Rochester	Fred C. Clarke
KFAM—Weber Bldg., St. Cloud	R. B. Witschen
WHLB—17th & 6th S., Virginia	Wm. Lounsberry
KWNO—216 Center, Winona	L. L. McCurnin

MISSISSIPPI

WROX—Clarksdale	Henry N. Fones
WCBI—Gilmer Hotel, Columbus	C. H. Dyess
WCMA—Ray Bldg., Corinth	W. M. Essary
WJPR—107 S. Poplar, Greenville	Horace Colby
WGRM—222 Howard, Greenwood	Wm. Lewis, Jr.
WGCM—Hewes-Martin Bldg., Gulfport	Donovan Murphy
WFOR—302 Hemphill, Hattiesburg	B. B. McLemore
WJDX—Box 2171, Jackson	Percy G. Root
WJXN—1200 N. State, Jackson	Murray Ellington
WSLI—Box 1847, Jackson	C. A. Perkins
WAML—535½ Central, Laurel	Clyne Graves
WSKB—McComb	R. L. Sanders
WMIS—407 Franklin, Natchez	Geo. W. Wilson
WELO—Tupelo	LeRoy Green
WQBC—Vicksburg Hotel, Vicksburg	C. E. Drake

MISSOURI

KFVS—324 Broadway, Cape Girardeau	Oscar C. Hirsch
KFRU—9th & Elm, Columbia	R. H. Haigh
KHMO—Hannibal	Ben Parrish
KWOS—210 Monroe, Jefferson City	Harold White
WMBH—Frisco Bldg., Joplin	R. P. Meek
KCKN—300 Waltower Bldg., Kansas City	Maxell Williams
KCMO—Commerce Bldg., Kansas City	K. Troeglen
KMBC—Pickwick Hotel, Kansas City	A. R. Moler
WDAF—1729 Grand, Kansas City	Jos. A. Flaherty
WHB—Scarritt Bldg., Kansas City	H. E. Goldenberg
KWOC—1801 N. Main, Poplar Bluff	Don M. Lidenton
KFEQ—Schneider Bldg., St. Joseph	J. Wesley Koch
KFUO—801 DeMun, St. Louis	Albert H. Wiese
KMOX—401 S. 12th, St. Louis	Harry Harvey
KWK—Hotel Chase, St. Louis	N. J. Zehr
KXOK—12th & Delmar, St. Louis	Arthur P. Rekart
WEW—3642 Lindell, St. Louis	Geo. E. Rueppel
WIL—Melbourne Hotel, St. Louis	E. Goodberlet
KDRO—2100 W. Broadway, Sedalia	Wayne Pash
KGBX—508 E. St. Louis, Springfield	Dennis White
KTTS—Chamber of Com. Bldg., Springfield	W. F. Curry
KWTO—508 St. Louis, Springfield	Fritz Bauer

MONTANA

KGHL—5th & N. Broadway, Billings	Jeff Klichli
KRBM—Bozeman	Jack Proris

ENGINEERS STUDY ENGINEERING FEATURES

Viewing one of the first Federal 1-3 kw FM transmitters to come off the production line are: Gordon Wright FTR engineer; E. N. Wendell FTR vice-president in charge of engineering and sales; A. B. Chamberlain, chief engineer CBS; and Howard Chinn, CBS chief audio engineer

Radio Station and Address	Chief Engineer
KGIR—Butte	Jack Provis
KFBB—First Natl. Bank Bldg., Great Falls	Wilbur Myhre
KPFA—1306 11th, Helena	R. D. Martin
KGEZ—203 1st E., Kalispell	W. H. Patterson
KRJF—16 N. 5th, Miles City	Ian Elliot
KGVO—132 W. Front, Missoula	Merrill F. Chapin
KGCX—109 S. Central, Sidney	Oscar Halerson

NEBRASKA

KORN—Pathfinder Hotel, Fremont	Wm. Baldwin
KMMJ—Cedar & Division, Grand Island	Norval Larsen
KFBB—Great Falls	Wilbur L. Myhoe
KHAS—Tribune Bldg., Hastings	Duane Allison
KGFW—Federal Annex Bldg., Kearney	Jack Lewis
KFAB—Sharp Bldg., Lincoln	Mark W. Bullock
KFOR—Stuart Bldg., Lincoln	C. W. Winkler
WJAG—Norfolk	Frank Weidenbach
KODY—1521 W. 12th, North Platte	J. Beauford Eaves
KBON—2027 Dodge, Omaha	Percy Zeigler
KFAB—Farnam Bldg., Omaha	Mark Bullock
KOIL—Omaha Natl. Bank Bldg., Omaha	C. W. Winkler
KOWH—World-Herald Bldg., Omaha	Frank E. Shopen
WOW—Insurance Bldg., Omaha	W. J. Kotera
KGKY—1517½ Broadway, Scottsbluff	H. Morrison

NEVADA

KBNE—P. O. Box H, Boulder City	R. E. Maichle
KENO—Box 1310, Las Vegas	Maxwell Kelch
KOH—143 Stevenson, Reno	Irven Carlsen

NEW HAMPSHIRE

WKNE—17 Dunbar, Keene	E. F. Batchelder, Jr.
WLNH—653 Main, Laconia	Louis C. Steady
WFEA—286 Franklin, Manchester	R. A. Schow
WMUR—1819 Elm, Manchester	Vincent H. Chandler
WHEB—Lafayette Rd., Portsmouth	Paul G. Lindsay

NEW JERSEY

WCAP—Convention Hall, Asbury Park	Alphonse Bressan
WBAB—1900 Atlantic, Atlantic City	Earle Godfrey
WFPG—Steel Pier, Atlantic City	Blair K. Thron
WSNJ—Bridgeton	Francis Fekel
WCAM—City Hall, Camden	Clarence E. Onens
WAAT—11 Hill, Newark	Frank V. Bremer
WPAT—7 Church, Paterson	Earl F. Lucas
WTTM—35 W. State, Trenton	Theo. P. Kilmer
WAWZ—Zarephath	Nathaniel Wilson

NEW MEXICO

KGGM—Kimo Bldg., Albuquerque	L. F. Dodds
KOB—418 W. Gold, Albuquerque	Geo. S. Johnson
KAVE—800 S. Canal, Carlsbad	Harland Nifong
KGAK—Gallup	E. L. Gemoets
KWEW—Hardin Hotel, Hobbs	Joe F. Marquez
KFUN—Box 710, Las Vegas	A. F. Schultz
KGFL—310 N. Richardson, Roswell	Melvin Unger
KVSF—759 Cerrillos, Santa Fe	B. L. Kennington
KTNM—Tucumcari	Arnold H. Haun

NEW YORK

WNBO—Metcalf Bldg., Auburn	Herbert House
WBTA—90 Main, Batavia	Fred Callendar
WNBF—Arlington Hotel, Binghamton	Lester H. Gilbert
WBBR—124 Columbia Hts., Brooklyn	R. H. Leffler
WBYN—1 Nevins, Brooklyn	Peter Testan
WBEN—Hotel Statler, Buffalo	R. J. Kingsley
WBNY—485 Main, Buffalo	Thomas L. Vines
WEBR—23 North, Buffalo	Raymond H. Lamy
WGR—Rand Bldg., Buffalo	Karl B. Hoffman
KWBW—Rand Bldg., Buffalo	Karl B. Hoffman
WENY—Mark Twain Hotel, Elmira	Thurlow A. Greene
WGBB—44 S. Grove, Freeport	Geo. Graham
WENT—8 W. Fulton, Gloversville	L. Edwin Rybakiewicz
WHCU—Savings Bank Bldg., Ithaca	True McLean
WJTN—Hotel Jamestown, Jamestown	Harold J. Kratzert
WKNY—Broadway Theatre Bldg., Kingston	F. H. Boisvert
WMSA—Central Bldg., Massena	M. R. Yonkovig
WALL—14 South, Middletown	Martin Karig
WGNY—161 Broadway, Newburgh	Marvin Seimes
WABC—485 Madison Ave., New York	Henry Grossman
WBNX—260 E. 161st, New York	A. I. Solbrig
WEAF—30 Rockefeller Plaza, New York	F. A. Wankel
WEVD—117 W. 46th, New York	Chas. W. Brown
WHN—1540 Broadway, New York	Paul Fueling
WHOM—29 W. 57th, New York	Theo. Gempp
WINS—28 W. 44th, New York	Paul von Kunits
WJZ—30 Rockefeller Plaza, New York	Geo. O. Milne
WLIB—850 Flatbush Ave., Brooklyn	Frank E. Knaack
WMCA—1657 Broadway, New York	Pierre C. Verseput
WNEW—501 Madison Ave., New York	M. J. Weiner
WNYC—Municipal Bldg., New York	John De Prospo
WOR—1440 Broadway, New York	J. R. Poppele
WQV—730 5th Ave., New York	H. W. Holt
WQXR—730 5th Ave., New York	R. D. Valentine
WWRL—41-38 58th, Woodside, L. I.	W. H. Reuman
WHLD—Hotel Niagara, Niagara Falls	Elwood D. Hiatt
WSLB—2315 Knox, Ogdensburg	Clifford Moore
WHDL—Exchange Natl. Bank, Oleon	Thomas J. Gill
WMFF—153 Margaret, Plattsburg	Jan King
WKIP—42 Market, Poughkeepsie	Marvin Seimes
WHAM—111 East, Rochester	Kenneth Gardner
WHEC—40 Franklin, Rochester	Bernard O'Brien
WSAY—Taylor Bldg., Rochester	Gordon P. Brown
WNBZ—14 Broadway, Saranac Lake	H. B. Williams
WGY—1 River Rd., Schenectady	W. J. Purcell
WSNY—619 State, Schenectady	Irving P. Beck
WAGE—Loew Bldg., Syracuse	C. W. Brannen
WFBL—433 S. Warren, Syracuse	Alfred R. Marcy
WOLF—Chimes Bldg., Syracuse	Thomas Crimmins
WSYR—Syracuse-Kemper Bldg., Syracuse	A. G. Belle Isle
WHAZ—110 8th, Troy	W. C. Stoker
WTRY—92 4th, Troy	Albert H. Chismark
WIBX—First Natl. Bank Bldg., Utica	John T. Dowdell
WWNY—Hotel Woodruff, Watertown	Maynard B. Davis
WFAS—Roger Smith Hotel, White Plains	Frank A. Seitz

NORTH CAROLINA

WISE—98 College, Asheville	C. W. Sumner
WWNC—14 O. Henry, Asheville	Cecil B. Hoskins
WBBB—310½ S. Main, Burlington	Berry Tysor
WAYS—120 E. 3rd, Charlotte	Paul T. Absher
WBT—Wilder Bldg., Charlotte	M. J. Minor
WSOC—1925 N. Tryon, Charlotte	L. L. Caudle, Jr.
WEGO—Concord	W. M. Nelson
WDNC—138½ E. Chapel Hill, Durham	Walter S. Hill
WCNC—104 E. Colonial, Elizabeth City	Joe Kyle
WFNC—114 Anderson, Fayetteville	Foy T. Hinson
WGNC—168 W. Main, Gastonia	W. C. Groves, Jr.
WGBR—Box 1024, Goldsboro	Daniel B. Trueblood
WBIG—O. Henry Hotel, Greensboro	Earl Allison
WGBG—Ashe St. Extension, Greensboro	Jas. Stewart
WGTC—Box 898, Greenville	James Mayo
WHNC—19 Williams, Henderson	Leon Small
WHKY—Radio Bldg., Hickory	Edmund S. Long
WMFR—Security Bank Bldg., High Point	Robert L. Moore
WJNC—Route 24 N., Jacksonville	Elmo Cronk
WFTC—210 E. King, Kinston	Herman Civils
WHIT—U.S. Hway. No. 17 S., New Bern	D. E. Hardison
WPTF—Insurance Bldg., Raleigh	Henry Hulick, Jr.
WRAL—131 S. Salisbury, Raleigh	Stanley Brown
WCBT—251 Roanoke, Roanoke Rapids	C. W. Meares
WEED—Box 752, Rocky Mount	I. G. Murphrey
WSTP—Yadkin Hotel, Salisbury	Carl B. Watson
WRRF—Bank of Washington Bldg., Washington	G. Martin
WMFD—Castle Hayne Rd., Wilmington	E. I. Herring, Jr.
WGTM—Wilson	Wm. H. Malone
WAIR—Pepper Bldg., Winston-Salen	Lee C. King
WSJS—419 N. Spruce, Winston-Salem	Philip F. Hedrick

NORTH DAKOTA

KFYR—320 Broadway, Bismarck	Ivar Nelson
KDLR—1025 3rd, Devils Lake	Richard Moritz
WDAY—Black Bldg., Fargo	Juline Savold
KFJM—Grand Forks	Arnold Petrich
KILO—First Natl. Bank Bldg., Grand Forks	A. Petrich
KSJB—Midland Bldg., Jamestown	Lloyd R. Amoo
KGCU—200 3rd N.W., Mandan	LeRoy Gunderson
KLPM—118A S. Main, Minot	C. W. Baker
KOVC—312 5th, Valley City	Kermit Holm

OHIO

WADC—Box 830, Akron	J. L. Wildermuth, Jr.
WAKR—First Central Tower, Akron	George Paul
WHKK—51 W. State, Akron	James S. Hill
WICA—221 Center, Ashtabula	H. R. Johnson
WHBC—550 S. Market, Canton	Kenneth L. Sliker
WCKY—Hotel Gibson, Cincinnati	C. H. Topmiller
WCPO—Carew Tower, Cincinnati	Glen A. Davis
WKRC—Hotel Alms, Cincinnati	Geo. A. Wilson
WLW—Crosley Square, Cincinnati	R. J. Rockwell
WSAI—115 E. 4th, Cincinnati	W. E. Symons
WGAR—Hotel Statler, Cleveland	R. Morris Pierce
WHK—Terminal Tower, Cleveland	Ralph H. DeLany
WJW—1375 Euclid, Cleveland	Gerald Roberts
WTAM—815 Superior N.E., Cleveland	S. E. Leonard
WBNS—33 N. High, Columbus	Lester H. Nafzger
WCOL—33 N. High, Columbus	Leo DeConnick
WHKC—22 E. Gay, Columbus	Wm. C. Minor
WOSU—Communication Lab., Columbus	Robert C. Higgy
WHIO—45 S. Ludlow, Dayton	Ernest L. Adams
WING—121 N. Main, Dayton	Paul F. Braden
WFIN—500½ S. Main, Findlay	Edgar C. Smith
WMOH—Second Natl. Bank Bldg., Hamilton	A. F. Bruck
WLOK—National Bank Bldg., Lima	Darrel J. Hunter
WMAN—140½ Park W., Mansfield	Wm. E. Morrison
WMRN—N. Main, Marion	Francis J. Peters
WPAY—1009 Gallia, Portsmouth	Maurice L. Myers
WIZE—117 W. High, Springfield	Victor L. Bushong
WSTV—Exchange Realty, Steubenville	Jos. M. Troesch
WSPD—136 Huron, Toledo	F. M. Hilbert
WTOL—Bell Bldg., Toledo	F. J. Sheehan
WRRN—108 Main, Warren	Robert V. Kinney
WFMJ—101 W. Boardman, Youngstown	F. A. Dieringer
WKBN—17 N. Champion, Youngstown	B. T. Wilkens
WHIZ—Lind Arcade Bldg., Zanesville	J. Atkinson

OKLAHOMA

KADA—First Natl. Bank Bldg., Ada	Harold Walker
KVSO—Hotel Ardmore, Ardmore	John C. Molloy
KWON—Union Nat. Bk., Bartlesville	E. D. DeGraffenreid
KASA—204 N. Main, Elk City	G. M. Patterson
KCRC—Broadway Tower, Enid	Murray D. Coleman
KSWO—17th & E, Lawton	W. E. Billington
KBIX—Box 1512, Muskogee	Bruce Dennis
WNAD—Faculty Exchange, Norman	Clyde L. Farrar
KOCY—Plaza Court, Oklahoma City	Geo. Brock
KOMA—Biltmore Hotel, Oklahoma City	M. W. Thomas
KTOK—Apco Tower, Oklahoma City	Clifford M. Easum
WKY—Skirvin Tower, Oklahoma City	H. J. Lovell
KHBG—McCullouch Bldg., Okmulgee	J. R. Jones
WBBZ—615 W. Grand, Ponca City	N. DeFrancesco
KGFF—Aldridge Hotel, Shawnee	Salvatore Ricciotti
KOME—910 S. Boston, Tulsa	R. T. Brown
KTUL—Natl. Bank of Tulsa Bldg., Tulsa	R. E. Snider
KVOO—Philtower Bldg., Tulsa	L. W. Stinson

OREGON

Radio Station and Address	Chief Engineer
KWIL—15th & Elm, Albany	Ken McCoy
KAST—404 Commercial, Astoria	James M. Titus
KBKR—1st & Court, Baker	Sidney Williams
KBND—1101 Wall, Bend	Wallace J. Guthrie
KOAC—Corvallis	Grant S. Feikert
KODL—Scenic Drive, The Dalles	M. E. Johnston
KORE—Route 3, Eugene	Harold M. Gander
KUIN—Box 148, Grants Pass	Edward A. Malone
KFJI—213 Main, Klamath Falls	Wm. P. Grimes
KFLW—Esplanada & Pine, Klamath Falls	G. E. Walters
KLBM—Oregon Trail Hway., La Grande	Sidney Williams
KMED—Ross Lane, Medford	Dave Rees
KWRC—Box 178, Pendleton	Robert M. Eaton
KALE—Studio Bldg., Portland	A. E. Richmond
KBPS—546 N. E. 12th, Portland	Chas. Weagant
KEX—815 W. Yamhill, Portland	Thomas T. Ely
KGW—1011 S. W. 6th, Portland	H. C. Singleton
KOIN—New Heathman Hotel, Portland	L. S. Bookwalter
KWJJ—1011 S. W. 6th, Portland	Frank Hood
KXL—Box 311, Portland	H. H. Schoolfield, Jr.
KRNR—132 N. Jackson, Roseburg	E. Leroy Hiatt
KSLM—Senator Hotel Bldg., Salem	Clyde Carlton

PENNSYLVANIA

WSAN—39 N. 10th, Allentown	Russell R. Taylor
WFBG—1318 11th, Altoona	Geo. R. Burgoon
WISR—357 N. Main, Butler	P. F. Rex
WCED—80 N. Park, DuBois	Vernon Stahl
WEST—516 Northampton, Easton	J. E. Mathiot
WERC—131 W. 10th, Erie	Thomas Phillips, Jr.
WLEU—Commerce Bldg., Erie	Clarence A. Baker
WHJB—Penn Albert Hotel, Greensburg	Lyle L. Allen
WSAJ—Hall of Science, Grove City	H. W. Harmon
WHP—216 Locust, Harrisburg	E. Daniel Leibensperger
WHGB—Harrisburg	G. B. Buffington
WKBO—31 N. 2nd, Harrisburg	Park Cassady
WAZL—Hazleton Natl. Bank, Hazleton	J. E. Mathiot
WDAD—637 Philadelphia, Indiana	V. J. Sullivan
WJAC—Tribune Annex, Johnstown	N. L. Straub
WGAL—8 W. King, Lancaster	J. E. Mathiot
WMRF—Monument Sq., Lewistown	Bernard H. Bopp
WKST—Cathedral Bldg., New Castle	R. S. Emch
WKPA—810 5th, New Kensington	W. W. Neely
KYW—1619 Walnut, Philadelphia	I. N. Eney
WCAU—1622 Chestnut, Philadelphia	Geo. Lewis
WDAS—1211 Chestnut, Philadelphia	F. W. Unterberger
WFIL—Widener Bldg., Philadelphia	Louis E. Littlejohn
WHAT—1503 Walnut, Philadelphia	H. Eckstein
WIBG—1425 Walnut, Philadelphia	John H. Henninger
WIP—35 S. 9th, Philadelphia	Clifford C. Harris
WPEN—1518 Walnut, Philadelphia	Chas. Burtis
WTEL—4312 N. Broad, Philadelphia	E. D. Hibbs
KDKA—Grant Bldg., Pittsburgh	T. C. Kenney
KQV—Union Trust Bldg., Pittsburgh	J. C. Price
WCAE—Hotel William Penn, Pittsburgh	James Schultz
WJAS—C. of C. Bldg., Pittsburgh	Walter W. McCoy
WWSW—Hotel Keystone, Pittsburgh	Henry R. Kaiser
WEEU—533 Penn, Reading	Harold Schearer
WRAW—5th & Court, Reading	E. A. Gurtowski
WARM—Select Bldg., Scranton	A. W. Oschmann
WGBI—1000 Wyoming, Scranton	K. R. Cooke
WPIC—Box 541, Sharon	A. C. Heck
WMAJ—Glennland Bldg., State College	Douglas I. Beman
WKOK—1150 N. Front, Sunbury	John W. Keller, Jr.
WMBS—Fayette Bldg., Uniontown	Wm. Hemly
WJPA—Geo. Washington Hotel, Washington	Frank Krulee
WBAX—141 S. Main, Wilkes-Barre	John H. Stenger, Jr.
WBRE—62 S. Franklin, Wilkes-Barre	Chas. Sakoski
WRAK—244 W. 4th, Williamsport	Louis N. Persio
WORK—13 S. Beaver, York	J. E. Mathiot
WSBA—R. D. No. 5, York	Willis N. Weaver

RHODE ISLAND

WFCI—450 Main, Pawtucket	Gilbert Johnson
WEAN—Crown Hotel, Providence	Harry H. Tilley
WJAR—176 Weybosset, Providence	Thos. C. J. Prior
WPRO—15 Chestnut, Providence	John V. Ferri

SOUTH CAROLINA

WAIM—Anderson College, Anderson	Morton E. Green
WCSC—Marion Hotel, Charleston	Wilbur R. Albee
WTMA—133 Church, Charleston	D. M. Bradham
WCOS—1202 Main, Columbia	Harry Clippard
WIS—1811 Main, Columbia	Herbert G. Eldson, Jr.
WKIX—1127 Lady, Columbia	Edwin Davis
WLAT—Box 139, Conway	Herman L. Hanks
WOLS—129 S. Dargan, Florence	Wm. Pritchett
WFBC—Poinsett Hotel, Greenville	W. C. Etheredge
WMRC—3 College, Greenville	Geo. D. Tate
WCRS—Wilson, Greenwood	Harold C. Spengler
WRHI—Rock Hill Bldg., Rock Hill	Jas. S. Beaty, Jr.
WORD—291 E. Main, Spartanburg	Francis I. Harr
WSPA—224 E. Main, Spartanburg	H. Beckholt
WFIG—Radio Center Bldg., Sumter	James L. Williams

SOUTH DAKOTA

KABR—117½ S. Main, Aberdeen	D. T. Hunt
KGFX—203 W. Summit, Pierre	Robert H. Dye
KOTA—Johnson Hotel, Rapid City	A. E. Griffiths
KELO—317 S. Phillips, Sioux Falls	Max Staley
KSOO—317 S. Phillips, Sioux Falls	Max Staley
KUSD—Union Bldg., Vermillion	Steve Graff
KWAT—Watertown	Francis Alwin
WNAX—2nd & Capitol, Yankton	Clifton Todd

TENNESSEE

WOPI—310 State, Bristol	B. Daugherty
WAPO—Read House, Chattanooga	B. B. Barnes
WDEF—Volunteer Bldg., Chattanooga	B. C. Baker

★ ELECTRONIC MARKETING

Radio Station and Address	Chief Engineer
WDOD—Hamilton Bank, Chattanooga	Julius C. Vessels
WJZM—Masonic Temple Bldg., Clarksville	E. Penticost
WBAC—Fike Bldg., Cleveland	Wm. F. Lange
WHUB—523 E. Spring, Cookeville	Hubert Beasley
WTJS—104 W. Baltimore, Jackson	Robert Gordon
WJHL—412 S. Roan, Johnson City	O. K. Garlund
WKPT—222 Commerce, Kingsport	Ike Upchurch
WBIR—406 W. Church, Knoxville	J. Rex Horton
WNOX—110 S. Gay, Knoxville	John L. Cole, Jr.
WROL—531 S. Gay, Knoxville	James Gilbert
WHBQ—Hotel Gayoso, Memphis	Welton M. Roy
WMC—495 Union, Memphis	E. C. Frase, Jr.
WMPS—61 N. Main, Memphis	Joe Deaderick
WREC—Hotel Peabody Bldg., Memphis	S. D. Wooten, Jr.
WLAC—Third Natl. Bank Bldg., Nashville	F. D. Binns
WSM—301 7th N., Nashville	Geo. Reynolds

TEXAS

KRBC—Abilene	J. B. Casey
KFDA—109 E. 5th, Amarillo	Noel E. Luddy
KGNC—Radio Bldg., Amarillo	W. H. Torrey
KNOW—Capital Natl. Bank Bldg., Austin	James E. Lewis
KTBC—Brown Bldg., Austin	Frank W. Yeagley
KFDM—Box 2950, Beaumont	Lawrence Sanders
KRIC—130 Wall, Beaumont	Ben Hughes
KBST—702 Johnson, Big Spring	Andrew M. Jones
KNEL—106 N. Blackburn, Brady	David Gattis
KVAL—Brownsville	C. M. Hamner
KBWD—800 Hawkins, Brownwood	A. W. Stewart
WTAW—College Station	Frank J. Soselik
KEYS—Center Theatre, Corpus Christi	Harold Griffith
KRIS—Corpus Christi	R. S. Bush
KWBU—Corpus Christi	Nestor Cuesta, Jr.
KAND—Corsicana	E. R. Hellums
KRLD—Hotel Adolphus, Dallas	Roy M. Flynn
KSKY—Hotel Stoneleigh, Dallas	Morris M. Ming
WFAA—1122 Jackson, Dallas	Raymond Collins
WRR—Municipal Radio Bldg., Dallas	Durward J. Tucker
KDNT—Kimbrough Bldg., Denton	Harwell V. Shepard
KROD—2201 Wyoming, El Paso	Edward P. Talbott
KTSM—Hotel Paso Del Norte, El Paso	K. J. Walton
KFJZ—1201 W. Lancaster, Ft. Worth	Truett Kimzey
KGKO—Medical Arts Bldg., Ft. Worth	R. C. Stinson
WBAP—Medical Arts Bldg., Ft. Worth	R. C. Stinson
KLUF—6002 Broadway, Galveston	John T. McClain
KGBS—Box 711, Harlingen	Sherman L. Spencer
KPRC—Lamar Hotel, Houston	H. T. Wheeler
KTHT—So. Standard Bldg., Houston	Louis I. Jelly
KTRH—Rice Hotel, Houston	King H. Robinson
KXYZ—Gulf Bldg., Houston	Gerald R. Chinski
KSAM—Box 312, Huntsville	Frank B. Wood
KOCA—Kilgore	Karem O. Soule
KPAB—Hamilton Hotel, Laredo	K. Hulan Smith
KFYO—914 Ave. J, Lubbock	W. S. Bledsoe
KRBA—Box 755, Lufkin	Ambrose Maxim
KCRS—117 S. Loraine, Midland	Jack Cecil
KNET—Municipal Bldg., Palestine	Bill Laurie
KPDN—Box 901, Pampa	Doug Smith
KPLT—Gabraltar Hotel, Paris	Robert A. Harmon
KIUN—306 S. Cedar, Pecos	Harry Boehnemann
KVOP—111 W. 6th, Plainview	Carl C. Cook
KPAC—1515 Lakeshore Dr., Port Arthur	Glenn Boatright
KGKL—St. Angeles Hotel, San Angelo	Frank Jones
KABC—Milam Bldg., San Antonio	Paul Wolf
KMAC—National Bank, San Antonio	Ed. E. Chase
KONO—317 Arden Grove, San Antonio	Geo. W. Ing
KTSA—Gunter Hotel, San Antonio	W. G. Egerton
WOAI—1031 Navarro, San Antonio	Fred L. Sterling
KRRV—421 N. Crockett, Sherman	Tom E. Spellman
KXOX—Hi-way 70, Sweetwater	Geo. W. Dotson
KTEM—Box 186, Temple	Paul Shaw
KCMC—317 Pine, Texarkana	Harvey Robertson
KGKB—115 S. College, Tyler	John B. Sheppard
KVWC—1813 Wilbarger, Vernon	H. F. Ridgway
KVIC—Bank & Trust Bldg., Victoria	R. L. McCown
WACO—Amicable Bldg., Waco	L. H. Applemen
KRGV—201 Border, Weslaco	Lewis Hartwig
KWFT—Kemp Hotel, Wichita Falls	John Adams

UTAH

KSUB—Hotel El Escalante, Cedar City	Hurschell Urie
KVNU—1393 N. Main, Logan	Carroll Secrist
KLO—Hotel Ben Lomond, Ogden	W. D'Orr Cozzens
KOVO—108 W. Center, Provo	P. P. Rasmuseen
KALL—248 S. Main, Salt Lake City	Stanley Benson
KDYL—Tribune-Telegram, Salt Lake City	J. M. Baldwin
KNAK—Continental Bank, Salt Lake City	Howard Johnson
KSL—10 S. Main, Salt Lake City	C. Richard Evans
KUTA—29 S. State, Salt Lake City	Lyle O. Wahlquist

VERMONT

WCAX—137 Main, Burlington	James W. Tierney
WSYB—80 West, Rutland	N. K. Ransom, Jr.
WWSR—32 N. Main, St. Albans	Theo. H. Boisvert
WDEV—8 Stowe, Waterbury	Harold Grout

VIRGINIA

WPIK—Hotel Geo. Mason, Alexandria	Carl L. Lindberg
WCHV—4th & E. Market, Charlottesville	Walter W. Gray
WKEY—214 Main, Covington	J. H. Metz
WBTM—Hotel Danville Bldg., Danville	Lyle Motley
WFVA—Box 269, Fredericksburg	Walter Harris
WSVA—Newman Bldg., Harrisonburg	David A. Nichols
WLVA—Allied Arts Bldg., Lynchburg	John T. Orth
WMVA—Figsboro Rd., Martinsville	Dewey W. Muse
WGH—Warwick Hotel, Newport News	Chas. A. Runyon
WTAR—Bank of Commerce Bldg., Norfolk	J. L. Grether
WSSV—112 W. Tabb, Petersburg	Edward Schwarz
WSAP—Professional Bldg., Portsmouth	F. F. Clair
WBBL—Richmond	Rudolph W. Raabe
WLEE—Broad-Grace Arcade, Richmond	Geo. McGuigan
WMBG—3301 W. Broad, Richmond	Wilfred H. Wood
WRNL—323 E. Grace, Richmond	Walter R. Selden
WRVA—Hotel Richmond, Richmond	D. C. Woods
WDBJ—Box 150, Roanoke	J. Edward Newman
WSLS—Shenandoah Life Bldg., Roanoke	Joseph P. Briggs
WLPM—105 Bank, Suffolk	V. W. Rupp
WINC—Drawer 605, Winchester	Phil Whitney

WASHINGTON

KXRO—207½ Market E., Aberdeen	Bill Cunningham
KVOS—1321 Commercial, Bellingham	M. Featherkile
KELA—Box 720, Centralia	Ellwood W. Lippincott
KRKO—Everett	Earle J. Gerdon
KWLK—Bank of Commerce, Longview	John Dailey
KGY—Rockway-Leland Bldg., Olympia	Chas. A. Roark
KPKW—Pasco	Murray Durham
KONP—313 W. 1st, Port Angeles	Lloyd C. Sundstrom
KWSC—112 Old Science Hall, Pullman	Hugo L. Libby
KEVR—Smith Tower, Seattle	J. B. Hatfield
KIRO—Cobb Bldg., Seattle	Homer A. Ray, Jr.
KJR—Skinner Bldg., Seattle	F. J. Brott
KOL—1220 3rd, Seattle	Perry C. Lind
KOMO—Skinner Bldg., Seattle	F. J. Brott
KRSC—2939 4th S., Seattle	Geo. A. Freeman
KTW—7th & Spring, Seattle	Jas. S. Ross
KXA—Bigelow Bldg., Seattle	John H. Dubuque
KFIO—526 Riverside, Spokane	C. L. Brown
KFPY—Symons Bldg., Spokane	Geo. E. Langford
KGA—Radio Central Bldg., Spokane	A. G. Sparling
KHQ—Radio Central Bldg., Spokane	John Walker
KMO—914 B'way, Tacoma	J. D. Kolesar
KTBI—Puget Sound Bank Bldg., Tacoma	Don McCroskey
KVI—Rust Bldg., Tacoma	Willard D. Tiffany
KVAN—707½ Main, Vancouver	E. R. Means
KUJ—2nd & Rose, Walla Walla	M. L. MacLafferty
KPQ—2nd & Columbia, Wenatchee	R. B. Sutton
KIT—414 E. Yakima, Yakima	H. B. Murphy
KTYW—Terrace Hgts. Rd., Yakima	W. F. Howe

WEST VIRGINIA

WJLS—101½ Main, Beckley	Al J. Ginkel
WHIS—623 Commerce, Bluefield	P. T. Flanagan
WCHS—1016 Lee, Charleston	Wm. E. Dixon
WGKV—Empire Bldg., Charleston	G. Zaharis
WBLK—444½ W. Pike, Clarksburg	Jos. A. Wright
WMMN—208 Adams, Fairmont	Robert D. Hough
WSAZ—929½ 4th, Huntington	Leroy E. Kilpatrick
WLOG—Logan	Chas. L. Clifton
WAJR—446 Spruce, Morgantown	Raymond C. Spence
WPAR—Grinter Bldg., Parkersburg	Cecil Knowles
WBRW—Riverside Drive, Welch	Howard R. King
WKWK—16th & Market, Wheeling	Fred Baker
WWVA—Hawley Bldg., Wheeling	Edwin L. Keim
WBTH—Williamson	Robert Bullio

WISCONSIN

WHBY—600 S. Lawe, Appleton	Geo. E. Merkl
WATW—321 2nd W., Ashland	Hine Dahlbacka
WEAU—203 S. Barstow, Eau Claire	T. O. Jorgensen
KFIZ—18 W. 1st, Fond Du Lac	Wendell S. Meyers
WTAQ—Bellin Bldg., Green Bay	Wallace J. Stangel
WCLO—204 E. Milwaukee, Janesville	Wayne A. Clay
WKBH—Radio Bldg., LaCrosse	Alvin Leeman
WHA—Radio Hall, Madison	John H. Stiehl
WIBA—110 E. Main, Madison	Norman G. Hahn
WOMT—Radio Bldg., Manitowoc	W. F. Duben
WMAM—Radio Park, Marinette	A. L. Stewart
WIGM—Medford	Raymond Bohnert
WEMP—710 N. Plankinton, Milwaukee	Raymond H. Host
WISN—123 W. Michigan, Milwaukee	N. J. Richard
WTMJ—333 W. State, Milwaukee	Wm. Hebal
WOSH—151½ Main, Oshkosh	Nathan Williams
WIBU—RFD No. 2, Poynette	S. Sadler
WRJN—441 Main, Racine	F. L. Dechant
WJMC—1615 S. Main, Rice Lake	Robert P. Kolsky
WHBL—636 Center, Sheboygan	Herbert J. Mayer
WLBL—Stevens Point	H. O. Brickson
WDSM—Androy Hotel, Superior	J. Melvin Laskey
WSAU—125 3rd, Wausau	Roland W. Richardt
WFHR—141 W. Grand, Wisconsin Rapids	Bert Zielesch

WYOMING

KFBC—Plains Hotel, Cheyenne	Clark Grove
KPOW—557 N. Clark, Powell	Del Brandt
KVRS—1307 Wyoming, Rock Springs	Archie W. Buchanan
KWYO—19 N. Main, Sheridan	Bob Crossthwaite

TELEVISION

NEW YORK

WABD—515 Madison, New York	S. R. Patremio
WCBW—15 Vanderbilt, New York	Henry Grossman
WNBT—30 Rockefeller Plaza, New York	O. B. Hanson
WRGB—60 Washington, Schenectady	W. J. Purcell

PENNSYLVANIA

WPTZ—Philadelphia	R. J. Bowley

DISTRICT OF COLUMBIA

W3XWT—Harrington Hotel, Washington	Wm. Sayse

ILLINOIS

WBKB—190 N. State, Chicago	A. H. Brolly
W9XZV—6001 Dickens, Chicago	J. E. Brown

CALIFORNIA

W6XAO—3800 Mt. Lee Drive, Hollywood	Harry W. Lubcke
W6XYZ—5461 Marathon, Hollywood	Klaus Landsberg

FREQUENCY MODULATION

CALIFORNIA

Radio Station and Address	Chief Engineer
KHJ—FM—5515 Melrose, Los Angeles	Frank M. Kennedy

CONNECTICUT

WDRC—FM—750 Main, Hartford	I. A. Martino
WTIC—FM—26 Grove, Hartford	Herman D. Taylor

ILLINOIS

WBBM—FM—410 N. Michigan, Chicago	Geo. Sherman
WDLM—FM—820 N. LaSalle, Chicago	A. P. Frye
WGNB—FM—435 N. Michigan, Chicago	G. Wm. Lang
WWZR—FM—6001 Dickens, Chicago	Ross Utter

INDIANA

WMLL—FM—519 Vine, Evansville	Erwin Schoeny
WOWO—FM—925 S. Harrison, Ft. Wayne	Bruce H. Ratts
WABW—FM—445 N. Penn., Indianap.	Martin R. Williams
WSBF—FM—225 W. Colfax, So. Bend	Herbert G. Cole

LOUISIANA

WBRL—FM—444 Florida, Baton Rouge	Donald K. Allan

MAINE

WMTW—FM—21 Brookline, Boston	I. B. Robinson

MASSACHUSETTS

WBZ—FM—275 Tremont, Boston	W. H. Hauser
WBZA—FM—Hotel Kimball, Springfield	H. E. Randol
WTAG—FM—20 Franklin, Worcester	Elliot A. Browning
WGTR—FM—32 Mechanic, Worcester	J. E. Grahn

MICHIGAN

WENA—FM—615 Lafayette, Detroit	Carl H. Wesser
WLOU—FM—10 Witherell, Detroit	Wayne F. McDonnell

MINNESOTA

WDUL—FM—4th & Superior, Duluth	W. H. Lounsberry

MISSOURI

KOZY—FM—406 W. 34th, Kan. City	M. W. Woodward
KMBC—FM—Pickwick Hotel, Kansas City	Robin Compton

NEW JERSEY

Radio Station and Address	Chief Engineer
WFMN—FM—Alpine	Perry H. Osborn
WATT—FM—11 Hill, Newark	Frank V. Bremer

NEW YORK

WABC—FM—485 Madison, New York	Henry Grossman
WABF—FM—654 Madison, New York	Theo. B. Grenier
WBAM—FM—1440 B'way, New York	J. R. Poppele
WEAF—FM—30 Rockefeller Pl., New York	O. B. Hanson
WGHF—FM—10 E. 40th, New York	Herbert C. Florance
WGYN—FM—70 Pine, New York	Harvey Anhalt
WHNF—FM—1540 B'way, New York	Paul Fuelling
WNYC—FM—Center & Chambers, N. Y.	John De Prospo
WQXQ—FM—730 5th, New York	Russell D. Valentine
WHEF—FM—40 Franklin, Rochester	B. C. O'Brien
WHAM—FM—Sheraton Hotel, Roches.	Kenneth J. Gardner
WBCA—FM—408 State, Schenectady	Dwelle S. Hoag
WGFM—FM—1 River Rd., Schenectady	W. J. Purcell

NORTH CAROLINA

WMIT—FM—Box 2093, Winston-Salem	Phil Hedrick

OHIO

WELD—FM—33 N. High, Columbus	Lester H. Nafzger

PENNSYLVANIA

KYW—FM—1619 Walnut, Phila.	I. N. Eney
WCAU—FM—1622 Chestnut, Phila.	George Lewis
WFIL—FM—Widener Bldg., Phila.	L. E. Littlejohn
WIBG—FM—1425 Walnut, Phila.	John Henninger
WIP—FM—35 S. 9th, Phila.	Clifford C. Harris
WPEN—FM—1528 Walnut, Phila.	Chas. Burtis
KDKA—FM—310 Grant, Pittsburgh	T. C. Kenney
WMOT—FM—212 Wood, Pittsburgh	Henry B. Kaiser

TENNESSEE

WSM—FM—7th & Union, Nashville	Geo. Reynolds

UTAH

KSL—FM—10 S. Main, Salt Lake City	C. Richard Evans

WISCONSIN

WTMJ—FM—333 W. State, Milwaukee	Phil B. Laeser

SET MANUFACTURERS

A directory of companies whose products include receivers for AM, FM and television, police and amteur equipment

COMPANY	CHIEF ENGINEER	PURCHASING AGENT
Abbott Instrument, Inc., 8 W. 18th St., New York 11, N. Y.	S. Podnos	H. Bloom
Admiral Corp., 3800 Cortland St., Chicago 47, Ill.	Kenneth Turner	Frank J. Kazda
Air Associates, Inc., 5827 W. Century Blvd., Los Angeles 45, Calif.	P. H. Thomsen	J. S. Burton
Air Communications Co., 2233 Grand Ave., Kansas City, Mo.	E. D. Smith	N C. Yontz
Aireon Corp., Fairfax & Funston Rds., Kansas City 15, Kans.	W. R. Robinson	Arthur DesNoyers
Air King Products Co., Inc., 1523 63rd St., Brooklyn 19, N. Y.	Frank Hinners	M. Markowitz
Airplane & Marine Instruments, Clearfield, Pa.	Wm. F. Diehl	Irvan Edmunds
American Communications Corp., 306 Broadway, New York, N. Y.	E. M. Lurie	E. M. Lurie
Andrea Radio Corp., 43-20 34th St., Long Island City 1, N. Y.	Harold J. Heindel	Bruce B. Donald
Ansley Radio Corp., 41 St. Joes Ave., Trenton 9, N. J.	Arthur C. Ansley	C. A. Clinton
Apex Industries, Inc., 192 Lexington Ave., New York 16, N. Y.	M. Lerner	Sid Joffee
A. R. F. Products, 7627 Lake St., River Forest, Ill.	R. Hockstad	E. Maciszewski
Autocrat Radio Co., 3855 N. Hamilton Ave., Chicago 18, Ill.	H. D. Tofani	R. B. Gubbins
Automatic Radio Mfg. Co., Inc., 122 Brookline Ave., Boston 15, Mass.	J. S. DeMetrick	J. L. Frost
Aviola Radio Corp., Phoenix, Ariz.	Joseph Lorch	Paul Schmidt
Baronette Radio & Tube Corp., 220 Fifth Ave., New York, N. Y.	———	Chas. I. Robbins
Barr Electric Co., 1314 Forest Ave., Dallas 15, Texas	W. W. Barr	W. W. Barr
Belmont Radio Corp., 5921 W. Dickens Ave., Chicago 39, Ill.	W. Dunn	G. E. Neuhauser
Bendix Radio, Div. of Bendix Av. Corp., E. Joppa Rd., Towson 4, Md.	H. M. Detrick	J. J. Samuels
Biltmore Radio Corp., 15 Ave. A, New York, N. Y.	Walter Berry	Walter Berry
Browning Laboratories, Inc., 750 Main St., Winchester, Mass.	F. A. Spindell	E. D. Whitney
Capehart Div. of Farnsworth Tel. & R. Corp., Ft. Wayne 1, Ind.	J. H. Pressley	R. L. Colfax
Collins Radio Co., 2920 First Ave., Cedar Rapids, Iowa	———	John Wagner
Colonial Radio Corp., 254 Rano St., Buffalo 7, N. Y.	H. C. Forbes	J. K. McDonough
Columbia Electronics, Inc., 185 E. 122nd St., New York 35, N. Y.	Leon V. Cattan	Frederick Rooney
Communications Co., Inc., 300 Greco Ave., Coral Gables 34, Fla.	H. M. Gulick	J. P. Franzen
Communications Equipment Corp., 523 W. 6th St., Los Angeles 14, Calif.	Ellis E. White	M. I. Burkwall
Concert Master Radio & Telev. Co., 1800 Winnemac Ave., Chicago, Ill.	C. W. Morgan	M. S. Anderson
Concord Radio Corp., 901 W. Jackson Blvd., Chicago 7, Ill.	A. Rattray	W. E. Vant
Coronet Radio & Telev. Corp., 176 Scranton Ave., Lynbrook, N. Y.	M. S. DeCellys	Alan Cahen
Crosley Corp., 1329 Arlington St., Cincinnati 25, Ohio	L. M. Clement	F. W. Warner
Crystal Products Co., 1816 Walnut St., Kansas City, Mo.	Ernest O. Ruff	Ralph E. Wilson
Delco Radio Div. of General Motors Corp., Kokomo, Ind.	B. A. Schwarz	R. Hill, Jr.
DeWald Radio Mfg. Corp., 440 Lafayette St., New York 3, N. Y.	Mark Glaser	Harry Rosenman
F. E. Dine & Co., Inc., 2221 Warwick Ave., Santa Monica, Calif.	F. E. Dine	J. Henderson
Allen B. Dumont Laboratories, 2 Main Ave., Passaic, N. J.	Fal Patremio	F. P. Rice
Dynavox Corp., 40-05 21st St., Long Island City, N. Y.	Martin Dworken	Joseph Dworken
Eastern Electronics Corp., 41 Chestnut St., New Haven 11, Conn.	Manfred Johnson	M. E. Fossett
Echophone Radio Co., 2611 S. Indiana Ave., Chicago, Ill.	Nelson P. Case	Ed Corcoran
Eckstein Radio & Telev. Co., 914 LaSalle Ave., Minneapolis 2, Minn.	E. A. Eckstein	E. A. Eckstein
Electrical Research & Mfg. Co., P.O. Box 3607, Terminal Annex, Los Angeles 54, Calif.	Floyd O'Neill	George L. Corcoran
Electromatic Mfg. Corp., 88 University Pl., New York, N. Y.	Paul H. Nachemson	John Winston
Electronic Devices Co., 601 W. 26th St., New York, N. Y.	Milton Delson Harry Chaney	Edward M. Delson
Electronic Corp. of America, 45 W. 18th St., New York 11, N. Y.	Garrard Mountjoy	Sal Preteger
Electronics, Inc., 645 Iowa St., Dubuque, Iowa	C. M. Cain	C. M. Cain
Emerson Radio & Phonograph Corp., 111—8th Ave., New York 11, N. Y.	A. G. Rogers	H. J. Dostal
Erco Radio Laboratories, Inc., 231 Main St., Hempstead, N. Y.	Edward Ruth III	Frank Ruth
Espey Mfg. Co., Inc., 528 E. 72nd St., New York 21, N. Y.	Harry Zion	Gordon Poole
Fada Radio & Electric Co., Inc., 30-20 Thomson Ave., Long Island City 1, N. Y.	Charles Honeywell	I. N. Marks
Farnsworth Television & Radio Corp., 3700 E. Pontiac St., Fort Wayne 1, Ind.	B. R. Cummings	B. Colfax
Federal Telephone & Radio Corp., 591 Broad St., Newark, N. J.	W. P. Short	Frank Lawson
Flush Wall Radio Co., 15 Washington St., Newark 2, N. J.	Sherid S. Bearder	L. R. Schenck
F. M. Radio Mfg. Co., Inc., 10408 Superior Ave., Cleveland, Ohio	Joseph Fair	Barney Lertzman
Franklin Photographic Industries, 223 W. Erie St., Chicago 10, Ill.	G. K. Smith	H. P. Macco
Freed Radio Corp., 200 Hudson St., New York 13, N. Y.	Murry Weinstein	M. Zalkin
Galvin Mfg. Corp., 4545 W. Augusta Blvd., Chicago 51, Ill.	D. H. Mitchell D. E. Noble	Carl Zehnle
Garnet Radio Corp., 69 Glenwood Pl., E. Orange, N. J.	Albert Hubert	H. T. Tudor
Garod Radio Corp., 70 Washington St., Brooklyn 1, N. Y.	Barnet Trott	Emanuel Weintraub
Gem Radio & Television Co., 140 Liberty St., New York 6, N. Y.	J. C. Rivman	J. C. Rivman
General Electric Co., 1285 Boston Ave., Bridgeport 2, Conn.	C. G. Fick	C. B. Adams
General Television & Radio Corp., 2701 N. Lehmann Court, Chicago 14, Ill.	William R. Kroening	Roy F. Sielisch
Gilfillan Bros., Inc., 1815 Venice Blvd., Los Angeles 6, Calif.	C. Frederick Wolcott	J. L. Forrest
Globe Electronics, Inc., 225 W. 17th St., New York 11, N. Y.	M. Dolgins	F. Emanuel
Gray Radio Co., W. Palm Beach, Fla.	F. E. Gray	G. H. DeShazo
Hallicrafters Co., 2611 S. Indiana Ave., Chicago 16, Ill.	Nelson P. Case	E. Corcoran
Hamilton Radio Corp., 510 Sixth Ave., New York 11, N. Y.	J. Ravdin	M. Landau
Hammarlund Mfg. Co., Inc., 460 W. 34th St., New York 1, N. Y.	E. A. Leach	P. P. Heaney
Harris Mfg. Co., 2422 W. 7th St., Los Angeles 5, Calif.	Fred Knowlden	J. Henry Harris
Harvey Machine Co., Inc., 6200 Avalon Blvd., Los Angeles 3, Calif.	A. J. Kornblum	E. D. Krantzman
Harvey-Wells Electronics, Inc., North St., Southbridge, Mass.	C. A. Harvey	E. Wiest
Herbach & Rademan Co., 522 Market St., Philadelphia, Pa.	J. E. Wagenseller	N. O. Rademan
Hoffman Radio Corp., 3430 S. Hill St., Los Angeles, Calif.	W. S. Harmon	P. L. Fleming
Howard Radio Co., 1735 Belmont Ave., Chicago 13, Ill.	W. James	O. Holen
Hudson American Corp., 25 W. 43rd St., New York 18, N. Y.	Abe Hass	A. C. Newman
Industrial Tool & Die Works, Inc., 2824 University Ave. S.E., Minneapolis, Minn.	C. E. Johnson	M. M. Matson
International Detrola Corp., Beard Ave. at Chatfield, Detroit 9, Mich.	R. M. Daugherty	R. H. Wann
Islip Radio Mfg. Corp., Islip, N. Y.	Warren A. Wiener	John V. Potter
Jefferson, Inc., Ray, 40 E. Merrick Rd., Freeport, L. I., N. Y.	G. W. Henke	Ray Jefferson
Jefferson-Travis Corp., 245 E. 23rd St., New York 10, N. Y.	Ohlrick Larsen	Paul Nichols
Jewel Radio Corp., 583 Sixth Ave., New York 11, N. Y.	Jack Zucker	Kimball H. Stark
Kaar Engineering Co., 619 Emerson St., Palo Alto, Calif.	John M. Kaar	E. W. Mersereau, Jr.
Kinetic Electronics Co., 235 E. 42nd St., New York, N. Y.	Edwin Spiegelthal	Eric Adair
Kingston Products Corp., Kokomo, Ind.	F. A. Dawson	L. G. Zimmerer
Lavoie Laboratories, Morganville, N. J.	August Schmeling	Harry Melnick
Lear, Inc., 230 E. Ohio St., Chicago, Ill.	L. G. Woycke	E. J. Babkes
Lewyt Corp., 60 Broadway, Brooklyn 11, N. Y.	R. Lee Freeman	J. Ralph Walker
Lincoln Electronics Corp., 653 11th Ave., New York 19, N. Y.	Robert E. Kayatt	Kathleen V. Daly
Link Radio Corp., 125 W. 17th St., New York 11, N. Y.	Fred'k T. Budelman	Abner G. Budelman
Magnavox Co., 2131 Bueter Rd., Fort Wayne, 4, Ind.	R. H. Dreisbach	M. J. Hayes
Maguire Industries, Inc., 342 W. Putnam Ave., Greenwich, Conn.	Hall Langstroth	W. Devanny
Maguire Industries, Inc., 936 Michigan Ave., Chicago, Ill.	E. J. Stanmyre	Wm. Covert
Majestic Radio & Television Corp., St. Charles, Ill.	Dudley E. Foster	A. G. Ginsberg

★ ELECTRONIC MARKETING

COMPANY	CHIEF ENGINEER	PURCHASING AGENT
Marco Industries, 245-A So. Beverly Dr., Beverly Hills, Calif.	Paul Brinkman	V. A. Marco
Maritime Radio Corp., 24 Whitehall St., New York 4, N. Y.	L. Sternberg	W. C. Williams
Mason Radio Products, Inc., 80 Prince St., Kingston, N. Y.	J. Edw. Greengard, Jr.	J. Edw. Greengard, Jr.
McGrade Mfg. Co., E. W., Porter Bldg., Kansas City 2, Mo.	J. G. Speer	Glenn Richardson
Meck Industries, Inc., John, Liberty St., Plymouth, Ind.	C. R. Wexler	B. Bethel
Mec-Rad Div. of Black Industries, 1400 E. 222nd St., Cleveland 17, Ohio	Robert MacGregor	H. L. Parmenter
Mectron Corp., Lawrence, Mass.	B. Jaeger	B. A. Goldstein
Medco Mfg. Co., 5 W. 45th St., New York 19, N. Y.	Anthony Lambo	G. B. Lucas
Megard Corp., 1601 S. Burlington Ave., Los Angeles 6, Calif.	Al Troup	A. R. Meyers
Meissner Mfg. Co., 936 N. Michigan Ave., Chicago, Ill.	E. J. Stanmyre	Wm. Covert
Metropolitan Electronic & Instrument Co., 6 Murray St., New York 7, N. Y.	J. Karns	A. Grossman
Midwest Radio Corp., 909 Broadway, Cincinnati 2, Ohio	P. Smith	D. Glover
James Millen Mfg. Co., Inc., 150 Exchange St., Malden 48, Mass.	Wade Caywood	George Pike
Minerva Corp. of America, 238 William St., New York 7, N. Y.	Herman Weissberger	Jack Saunders
National Co., Inc., 61 Sherman St., Malden 48, Mass.	W. J. Larkin	J. G. Woods
National Design Service, 96 Liberty St., New York 6, N. Y.	L. Zeitsoff	L. Zeitsoff
Noblitt-Sparks Industries, Inc., Columbus, Indiana	Ben H. Irwin	Louis L. Ackerman
Northern Radio Co., 2208 Fourth Ave., Seattle 1, Wash.	L. G. Reynolds	Lloyd C. Kemp
Packard-Bell Co., 3443 Wilshire Blvd., Los Angeles 5, Calif.	R. H. Freck	A. T. Baxter
Packard Mfg. Corp., 2900 Columbia Ave., Indianapolis, Ind.	E. E. Collison	J. F. Gigax
Pan American Electric Co., Inc., 132 Front St., New York 5, N. Y.	Gladden Houck, Jr.	Robert F. Petrino
Panoramic Radio Corp., 242 W. 55th St., New York 19, N. Y.	J. I. Heller	E. A. David
Philco Corp., Tioga & C Sts., Philadelphia 34, Pa.	D. B. Smith	Raymond A. Boyce
Pilot Radio Corp., 37-06 36th St., Long Island City 1, N. Y.	W. Auerbacher	H. Zuckerman
Precision Specialites, 210 N. Western Ave., Los Angeles 4, Calif.	M. R. Roberts	C. L. Gould
Premier Crystal Laboratories, Inc., 63 Park Row, New York 7, N. Y.	H. M. Bach	A. H. Zink
Radio Craftsmen, 1341 S. Michigan Ave., Chicago 5, Ill.	Byron M. Friend	I. Aurbach
Radio Development & Research Corp., 26 Cornelison Ave., Jersey City 4, N. J.	Robert Dorr	G. H. McCaffrey
Radio Engineering Labs., 35-54 36th St., Long Island City 1, N. Y.	M. H. Jennings	M. Wade
Radio Mfg. Engineers, Inc., 364 First Ave., Peoria, Ill.	R. M. Planck	K. N. Hecht
Radio Laboratories, 2701 California Ave., Seattle 6, Wash.	M. F. Kerr	Bryce Etherton
Radio Navigational Instrument Corp., 305 E. 63rd St., New York 21, N. Y.	J. Czernia	Rose Mehlman
Radio Process Co., 7618 Melrose Ave., Los Angeles 46, Calif.	A. Ellsworth	G. Marshall
Radio Receptor Co., Inc., 251 W. 19th St., New York 11, N. Y.	Everett D. Gibbs	William Ostrove
Radio & Television, Inc., 244 Madison Ave., New York 16, N. Y.	Glenn Browning	E. O. Brown
Radio Wire Television, Inc., 100 Sixth Ave., New York 13, N. Y.	L. Marko	H. Davis
Rauland Corp., 4245 N. Knox Ave., Chicago 41, Ill.	J. J. O'Callaghan	E. J. Linke
RayEnergy Radio & Telev. Corp. of America, 32 W. 22nd St., New York, N. Y.	Harold Kaplan	Carl Rappaport
RCA Victor Div., Radio Corp. of America, Camden, N. J.	D. F. Schmit	V. DeP. Goubeau
Recordo-O-Vox Inc., 721 N. Martel Ave., Hollywood 46, Calif.	S. Solat	S. Solat
Regal Electronics Corp., 20 W. 20th St., New York 11, N. Y.	Ben Waxler	Jack Krieger
Remler Co., Ltd., 2101 Bryant St., San Francisco 10, Calif.	Harry A. Greene	Geo. A. Coleman
Rex Products Co., 1313 W. Randolph St., Chicago, Ill.	William Kroening	Irving H. Siegel
R.G.H. Mfg. Corp., 214 E. 41st St., New York, N. Y.	David Geller	Sigmund Goldsmith
Rock-Ola Mfg. Corp., 800 N. Kedzie Ave., Chicago 51, Ill.	J. A. Briggs	J. J. Sears
E. M. Sargent Co., 212 9th St., Oakland 7, Calif.	L. C. Rayment	E. M. Sargent
Searle Aero Industries, Inc., P. O. Box 111, Orange, Calif.	Marshall O. Searle	M. W. Sattler
Schuttig & Co., 9th & Kearny Sts., N. E., Washington 17, D. C.	W. S. Williams	C. K. Vanderslice
Scophony Corp. of America, 527 Fifth Ave., New York, N. Y.	Arthur Levey	Dr. A. H. Rosenthal
Scott Radio Labs. Inc., 4541 Ravenswood Ave., Chicago, Ill.	Art Finnie	Harry Lavery
Sentinel Radio Corp., 2020 Ridge Ave., Evanston, Ill.	W. J. Schnell	P. O. Krumm
Setchell-Carlson, Inc., 2233 University Ave., St. Paul 4, Minn.	B. T. Setchell	Lyman D. Pew
Sheridan Electronics Corp., 2850 S. Michigan Ave., Chicago 16, Ill.	Frank Lorenz	J. H. Stackhouse
Signal Electronics, Inc., 114 E. 16th St., New York 3, N. Y.	John Benedikt	Betty Stohl
Silver Co., McMurdo, 1240 Main St., Hartford 3, Conn.	Owen Shepherd, Jr.	McMurdo Silver
Sonora Radio & Telev. Corp., 325 N. Hoyne Ave., Chicago 12, Ill.	Don Fetterman	Sadelle Liberman
Sonotone Corp., 92 Main St., White Plains, N. Y.	S. Richmond	A. J. Biggar
Sparks-Withington Co., 2400 E. Ganson St., Jackson, Mich.	Deloy Monroe	A. G. Lee
Speak-O-Phone Recording & Equip. Co., 23 W. 69th St., New York, N. Y.	J. C. Cordover	C. A. Austin
Stewart-Warner Corp., 1826 Diversey Parkway, Chicago 14, Ill.	George Oehlsen	R. F. Stiles
Stromberg-Carlson Co., 100 Carlson Rd., Rochester 3, N. Y.	Frederick C. Young	E. S. Edwards
Symphonic Radio & Electronic Corp., 292-298 Main St., Cambridge 42, Mass.	J. Speranza	M. H. Cogan
Taybern Equipment Co., 120 Greenwich St., New York, N. Y.	J. T. Bernsley	E. M. Sheppard
Tech-Master Products Co., 123 Prince St., New York, N. Y.	I. Aronson	L. Lazoff
Technical Radio Co., 275 9th St., San Francisco, Calif.	C. F. Bane	Geo. Weiss
Telicon Corp., 851 Madison Ave., New York 21, N. Y.	Richard Shottenfeld	Morton Kronengold
Teletone Radio Co., 609 W. 51st St., New York 19, N. Y.	B. Singer	A. Frankel
Templetone Radio Mfg. Corp., New London, Conn.	Dale Pollack	M. A. Gardner
Transmitter Equipment Co., 345 Hudson St., New York 14, N. Y.	Samuel A. Sack	F. C. Botscheller
Trav-Ler Karenola Radio & Tel. Corp., 571 W. Jackson Blvd., Chicago 6, Ill.	R. J. O'Brien	M. A. Kling
Trebor Radio Co., Pasadena 18, Calif.	J. Clark	John King
United Cinephone Corp., Torrington, Conn.	John M. Miller, Jr.	Douglas Pierce
Union Electronics Corp., 38-01 Queens Blvd., Long Island City, N. Y.	Louis Pressman	H. F. Marks
United Scientific Labs., Inc., 440 Lafayette St., New York, N. Y.	Mark Glaser	Harry Rosenman
United States Telev. Mfg. Corp., 106 Seventh Ave., New York 11, N. Y.	Harold V. Nielsen	Morris Bloom
Vibraloc Mfg. Co., 3597 Mission St., San Francisco, Calif.	Joseph Topping	Joseph Topping
Viewtone Co., 203 E. 18th St., New York 3, N. Y.	Albert Nadel	Louis Kane
V-lectrical Eng. Co., 828 N. Highland Ave., Hollywood 38, Calif.	Charles Zingle	E. P. Collins
Walsh Engineering Co., P. O. Box 430, Elizabeth 2, N. J.	Lincoln Walsh	E. E. Eckler
Warwick Mfg. Corp., 4640 W. Harrison St., Chicago 44, Ill.	Howard A. Gates	Gordon G. Brittan
Watterson Radio Mfg. Co., 2700 Swiss Ave., Dallas, Texas	D. C. O'Neill	M. O. Booth
Wells-Gardner & Co., 2701 N. Kildare Ave., Chicago 39, Ill.	L. J. Biskner	C. W. Pierson
Western Electric Co., 120 Broadway, New York, N. Y.	H. C. Beale	D. F. G. Eliot
Western Sound & Elec. Labs., Inc., 3512 W. St. Paul Ave., Milwaukee 8, Wisc.	Joseph M. Schmitz	Edw. M. Dieringer
Westinghouse Electric Corp., Receiver Div., Sunbury, Pa.	W. S. Winfield	J. R. Todd
Whiting & Davis Co., 23 W. Bacon St., Plainville, Mass.	Charles W. Rice	Edward Osterholm
Wilcox Electric Co., Inc., 1400 Chestnut St., Kansas City 1, Mo.	A. P. Stuhrman	J. M. Courtney
Wilcox-Gay Corp., 605 W. Seminary St., Charlotte, Mich.	Lawrence V. Wells	Frank E. Larner
Zenith Radio Corp., 6001 W. Dickens Ave., Chicago 39, Ill.	J. E. Brown	Harvey Tullo

Michigan Boulevard, Chicago, and Hotel Stevens which will house the 1946 Radio Parts & Electric Equipment Conference and Show, May 13-16

SHOW EXHIBITORS

A directory of manufacturers exhibiting at the Chicago show together with the location of their exhibit spaces

	Booth
Aerovox Corp., New Bedford, Mass.	90
Alliance Mfg. Co., Alliance, Ohio	98
Alpha Wire Corp., 50 Howard St., New York	141
American Coil & Engineering Co., 1271 North Hermitage Ave., Chicago	136
American Condenser Co., 4410 North Ravenswood Ave., Chicago	129
American Phenolic Corp., 1830 South 54th Ave., Cicero, Ill.	38
American Radio Hardware Co., Inc., 152 MacQuesten Parkway, Mt. Vernon, N. Y.	29
Amperex Electronic Corp., 79 Washington St., Brooklyn, N. Y.	67
Amperite Co., 561 Broadway, New York	133
Astatic Corp., Conneaut, Ohio	95
Atlas Sound Corp., 1443 39th St., Brooklyn, N. Y.	80
Audio Devices, Inc., 444 Madison Ave., New York	96
Belden Mfg. Co., P. O. Box 5070A, Chicago	87
Bell Sound Systems, Inc., 1183 Essex Ave., Columbus, Ohio	13
Bliley Electric Co., Erie, Pa.	6
David Bogen Co., 663 Broadway, New York	40
Brand & Co., William, 276 Fourth Ave., New York	105
British Industries Sales Corp., 276 Fourth Ave., New York	158
Brush Development Co., 3405 Perkins Ave., Cleveland, Ohio	65
Bud Radio, Inc., 2118 East 55th St., Cleveland	54
Burgess Battery Co., Freeport, Ill.	156
Camburn, Inc., 490 Broome St., New York	22
Cardwell Mfg. Corp., Allen D., 81 Prospect St., Brooklyn 1, N. Y.	97
Carron Mfg. Co., 415 S. Aberdeen St., Chicago	84
Centralab, 900 E. Keefe Ave., Milwaukee, Wis.	39
Cinaudagraph Corp., Stamford, Conn.	161
Clarostat Mfg. Co., Inc., 130 Clinton St., Bklyn.	124
Communication Measurements Lab., 120 Greenwich St., New York	28
Continental Carbon Inc., 13900 Lorain Ave., Cleveland, Ohio	149
Continental Electric Co., Geneva, Ill.	25
Corning Glass Works, Corning, N. Y.	66
Croname, Inc., 3701 N. Ravenswood Ave., Chicago	45
Crystal Research Laboratories, Inc., 29 Allyn St., Hartford, Conn.	137
DeMornay Budd, Inc., 475 Grand Concourse, New York	111
Deutschmann Corp., Tobe, Canton, Mass.	76
Dial Light Co. of America, Inc., 900 Broadway, New York	60
Drake Electric Works, Inc., 3656 Lincoln Ave., Chicago	73
Dumont Electric Corp., 34 Hubert St., New York	164
Duotone Co., Inc., 799 Broadway, New York	21
DX Radio Products Co., 1200 N. Claremont Ave., Chicago	109
Eastern Amplifier Corp., 794 East 140th St., New York	125
Eastern Electronics Corp., 41 Chestnut St., New Haven, Conn.	134
Electronic Soldering Iron Co., Inc., Deep River, Conn.	93
Electrical Reactance Corp., Franklinville, N. Y.	91
Electro Products Laboratories, 549 West Randolph St., Chicago	127
Electronic Engineering Co., 3223 W. Armitage Ave., Chicago	42
Electro-Voice, Inc., 1239 South Bend Ave., South Bend, Ind.	15
Erwood Co., 223 West Erie St., Chicago	104
Freed Transformer Co., 72 Spring St., New York	114
General Cement Mfg. Co., 919 Taylor Ave., Rockford, Ill.	79
General Electric Co., Schenectady, N. Y.	58
General Electronics, Inc., 1917 N. Springfield Ave., Chicago	33
General Industries Co., Elyria, Ohio	120
General Transformer Corp., 1250 W. Van Buren St., Chicago	59
Gothard Mfg. Co., 2110 Clear Lake Ave., Springfield, Ill.	150
Guardian Electric Mfg. Co., 1400 W. Washington Blvd., Chicago	51
Guthman & Co., Inc., Edwin I., 15 S. Throop St., Chicago	115
Halldorson Co., 4500 N. Ravenswood Ave., Chicago.	44
Hallicrafters Co., 2611 Indiana, Chicago	35
Hardwick, Hindle, Inc., 40 Hermon St., Newark, N. J.	130
Hammarlund Mfg. Co., Inc., 460 W. 34th St., New York	147
Hewlett-Packard Co., 395 Page Mill Road, Palo Alto. Cal.	126
Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland, Ohio	99
Hytron Radio & Electronics Corp., Salem, Mass.	69
Indiana Steel Products Co., 6 North Michigan Ave., Chicago	113
International Resistance Co., 401 N. Broad St., Philadelphia	103
Insuline Corp. of America, 36-02 35th Ave., Long Island City, N. Y.	34
Jackson Electrical Instrument Co., 16-18 Patterson Blvd., Dayton, Ohio	53
Jackson Industries, 1708 S. State St., Chicago.	37
Jefferson Electric Co., 25th Ave. & Madison St., Bellwood, Ill.	157
Jefferson-Travis Corp., 245 East 23rd St., New York	159
Jensen Radio Mfg. Co., 6601 S. Laramie Ave., Chicago	68
J. F. D. Mfg. Co., 4117 Fort Hamilton Parkway, Brooklyn, N. Y.	118
Johnson Co., E. F., Waseca, Minn.	92
Lectrohm Inc., 5129 W. 25th St., Cicero, Ill.	63
Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago	152
Littlefuse, Inc., 4757 North Ravenswood, Chicago.	123
Madison Electrical Products Co., 78 Main St., Madison, N. J.	55
P. R. Mallory & Co., Inc., 3029 East Washington St., Indianapolis, Ind.	36
Marion Electrical Instrument Co., Manchester, N. H.	17
Mark Simpson Mfg. Co., 186-194 West 4th St., New York	46
Meck Industries, John, Liberty St., Plymouth, Ind.	163
Meissner Mfg. Co., Mt. Carmel, Ill.	81
Merit Coil and Transformer Corp., 4427 N. Clark St., Chicago	52
Millen Manufacturing Co., Inc., James, 150 Exchange St., Malden, Mass.	57
Milwaukee Stamping Co., 800 South 72nd St., Milwaukee	19
Muter Co., 1255 S. Michigan Ave., Chicago.	89
McGrade Mfg. Co., E. W., Porter Building, Kansas City, Mo.	24
McMurdo Silver Co., 1240 Main St., Hartford, Conn.	16
National Co., Inc., 61 Sherman St., Malden, Mass.	108
National Union Radio Corp., 15 Washington St., Newark, N. J.	9
New York Transformer Co., 62 William St., New York	140
Ohio Tool Co., 3160 W. 106th St., Cleveland, Ohio.	131
Ohmite Mfg. Co., 4835 Flournoy St., Chicago.	72
Operadio Mfg. Co., St. Charles, Ill.	155
Oxford-Tartak Radio Corp., 3911 S. Michigan Ave., Chicago	5
Park Metalware Co., Inc., Bank St., Orchard Park, N. Y.	128
Par-Metal Products Corp., 32-62 49th St., Long Island City, N. Y.	3
Permo, Inc., 6415 Ravenswood Ave., Chicago.	117
Permoflux Corp., 4900 W. Grand Ave., Chicago.	32
Philmore Mfg. Co., 113 University Pl., New York.	119
Potter & Brumfield Mfg. Co., 549 W. Washington St., Chicago	12
Precision Apparatus Co., 92-27 Horace Harding Blvd., Elmhurst, N. Y.	143
Premax Products Division, Niagara Falls, N. Y.	18
Presto Recording Corp., 242 W. 55th St., New York.	135
Price Electric Corp., East Church & 2nd Sts., Frederick, Md.	30
Quam-Nichols Co., 33d Pl. & Cottage Grove Ave., Chicago	82
Racon Electric Co., Inc., 52 E. 19th St., New York.	122
Rad-El-Co Mfg. Co., 6300 Euclid Ave., Cleveland, Ohio	160
Radiart Corp., 3571 W. 62nd St., Cleveland, Ohio.	153
Radio City Products Co., Inc., 127 West 26th St., New York	62
Radio Essentials, Inc., 110 East 3rd St., Mt. Vernon, New York	71
Radio Mfg. Engineers, Inc., 300-306 First Ave., Peoria, Ill.	77
Rauland Corp., 4245 N. Knox Ave., Chicago	83
RCA, Camden, N. J.	145
Raytheon Mfg. Co., Newton, Mass.	110
Recordisc Corp., 395 Broadway, New York	2
Reiner Electronics Co., Inc., 152 W. 25th St., N. Y.	48
Rek-O-Kut Co., 146 Grand St., New York	70
Schott Co., Walter L., 9306 Santa Monica Blvd., Beverly Hills, Cal.	116
Shur-Antenna-Mount, Inc., Sea Cliff, N. Y.	162
Shure Brothers, 225 W. Huron St., Chicago.	85
Simpson Electric Co., 5200-18 W. Kinzie St., Chicago	112
Snyder Mfg. Co., 22nd & Ontario St., Philadelphia.	50
Solar Mfg. Corp., 285 Madison Ave., New York	148
Spirling Products Co., Inc., 60-62-64 Grand St., New York	10
Sprague Products Co., North Adams, Mass.	132
Stamford Electric Products Co., Inc., Stamford, Conn.	14
Standard Transformer Corp., 1500 North Halsted, Chicago	88
Stromberg-Carlson, Rochester, N. Y.	144
Stupakoff Ceramic & Mfg. Co., Latrobe, Pa.	138
Supreme Instruments Corp., Greenwood, Miss.	101
Sylvania Electric Products, Inc., Emporium, Pa.	86
Talk-A-Phone Mfg. Co., 1512 S. Pulaski Rd., Chicago.	121
Technical Appliance Corp., 41-06 DeLong St., N. Y.	146
Telegraph Apparatus Co., 412 S. Green St., Chicago	4
Thordarson Electric Mfg. Div., 500 W. Huron St., Chicago	94
Trimm, Inc., 1770 W. Berteau Ave., Chicago	74
Triplett Electrical Instrument Co., Bluffton, Ohio.	139
Tung-Sol Lamp Works, Inc., 95 Eighth Ave., Newark, N. J.	61
Turner Co., Cedar Rapids, Iowa	49
United Transformer Corp., 150 Varick St., New York	20
Universal Microphone Co., Inglewood, Cal.	41
University Laboratories, 225 Varick St., New York.	56
Utah Radio Products, 820 N. Orleans St., Chicago.	106
V-M Corp., 4th & Park Sts., Benton Harbor, Mich	154
Ward Leonard Electric Co., Mt. Vernon, N. Y.	100
Ward Products Corp., 1523 East 45th St., Cleveland, Ohio	102
Waterman Products Co., Inc., 2445-63 Emerald St., Philadelphia	26
Webster-Chicago Corp., 5610 Bloomingdale Ave., Chicago	43
Webster Electric Co., Clark & DeKoven Ave., Racine, Wis.	151
Weller Mfg. Co., Easton, Pa.	47
Westinghouse Electric Corp., Pittsburgh, Pa.	7
Weston Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark, N. J.	75
Wirt Co., 5221 Greene St., Philadelphia	78
Workshop Associates, 66 Needham St., Newton Highlands, Mass.	142
Worner Electronic Devices, 609 W. Lake St., Chicago	8

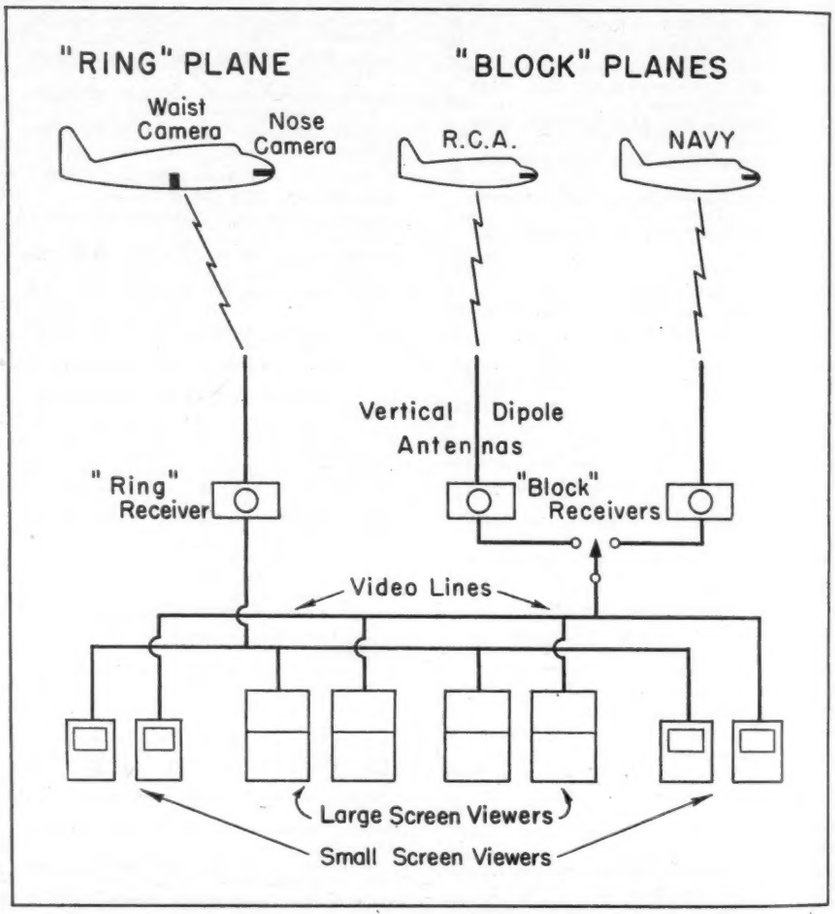
TV RECONNAISSANCE

Engineering details of RCA-Navy remote television equipment for military observation and control of guided missils

• Two airborne television systems, developed for military operations by scientists and engineers of the Navy and the Radio Corp. of America were demonstrated publicly for the first time at Anacostia Naval Air Base, D.C., late in March. The two systems, shown in operation for a couple of hours, bear the code names "Ring" and "Block", the former for long range television reconnaissance and the latter for short range observation and control of guided missils.

Airborne equipment comprised four television cameras and three transmitters linked to three VHF television receivers on the ground, with provision for selective switching of video signals to eight television screens. In each group of two screens, the left hand viewer was associated with the two "Ring" type cameras, while the right hand viewer displayed either of the "Block" camera images. The three broad band receiving antennas were vertical dipoles, provided with corner reflectors which could be manually rotated to "track" the planes in flight.

The large-screen viewers provided 16 x 21 in. images, utilizing the video portions of RCA home television receivers of the Schmidt lens projection type. Four of the smaller direct-view home receivers were provided for photographic and other purposes. "Pilot's eye" observation of aerial maneuvers was demonstrated to nearly 200 press representatives assembled in the Anacostia gymnasium, including a "television tour" of Washington landmarks and a view of eleven Navy planes in mock combat over Annapolis.



Arrangement of the RCA-Navy television network that relayed aerial views of Washington and vicinity to a group of observers in the Anacostia gymnasium. The terms "Ring" and "Block" were security code names assigned to this war development

Transmission standards

The "Ring" system standards were 567 lines, 40 fields, interlaced to form 20 frames/second. Video pass band from 20 c/s to 8 ms was obtained, 6db down at 10 mc. Two pickup cameras were used, one in the waist of the plane pointing down and using the new type 2P21 Image Orthicon, while another in the nose position used a type C7543C 4½ in. multiplier Orthicon, similar to the prewar type 1840 except for the addition of five stages of electron multiplication within the tube envelope.

Peak power of 1.4 kw was radiated from an exciter and power amplifier operating in the 90-102 mc band temporarily assigned to the "Ring" system. Complete switching and monitoring facilities were installed in the plane and operated by four engineers, in addition to Navy flight personnel. Maximum range of transmission under fair conditions of visibility was about 200 miles, requiring an altitude of 22,500 ft. "Ring" system equipment was originally designed, developed and tested by the NBC Engineering Dept. in cooperation with the Navy Bureau of Ships.

The "Block" system transmission was based on 350 line, 40 frame/second, sequential scanning, using semi-fixed pickup cameras and an improved version of the type 1840 Orthicon tube. Mounted in the nose sections of two small planes provided by RCA and the Navy, these units weigh only 70 lb. but deliver a peak power output of 60 watts at 264 to 372 mc. This equipment was designed and manufactured by RCA, in collaboration with Com. T. W. Chew and C. L. Stec, Bureau of Ships, Lt. Com. F. Griffiths and Lt. W. E. Thorp, Bureau of Aeronautics, and R. S. Taylor, civilian.

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NEWS OF THE INDUSTRY

Aieron Induction RR Radio Authorized

In a new departure in licensing policy, the FCC late in March authorized Aireon Mfg. Corp. to engage in experimental operation of inductive carrier radiocommunications with moving trains of the Kansas City Southern Railway. Permission for the inductive radio service for railroads indicated new licensing regulations and standards for this service in which Aireon has taken a leading role, along with the Union Switch & Signal Co., which is installing the system on the Pennsylvania Railroad.

Aireon was granted temporary authority for a period of three months to operate 22 portable and 10 mobile low-frequency transmitters along the right-of-way of the Kansas City Southern for communication with moving trains, principally by means of the induction of radio frequency currents to and from wayside telegraph landline conductors.

The twenty-two portable transmitters will be located at various wayside stations and the ten mobile transmitters will be installed on five cabooses and five locomotives to be operated on the KCS railroad between Kansas City, Mo., and Shreveport, La. The portable transmitters will have a maximum power of 6 watts and the mobile transmitters will operate with 50 watts maximum power. The frequency of 175 kc has been assigned on a temporary basis. All equipment will be designed for frequency modulation.

Thermador Reorganizes Executive Personnel

Several changes have been made in the executive personnel of the Thermador Electrical Mfg. Co., Los Angeles. William E. Cranston has been elected president of the organization succeeding Harrison H. Fogwell who has advanced to the post as chairman of the board. Cranston was formerly vice-president and general manager. Other changes involve the election of Clyde I. Harding as vice-president in charge of production, F. M. Pence, vice-president in charge of engineering and Frank A. Ballman, vice-president in charge of sales. The main office of the company is at 5119 District Blvd., Los Angeles.

Broadcast Engineers Plan Organization

Is there a need for a new, separate organization of broadcast engineers and technicians? Many engineers think there is. During the sixth annual Broadcast Engineering Conference, held March 18-23 at Ohio State University in Columbus, a movement was started looking to the formation of such a body provided sufficient interest in its possibilities should become evident. The idea originated in a letter addressed to Howard Frazier of NAB by Karl B. Hoffman, technical director for the Buffalo (N.Y.) Broadcasting Corp., which operates station WKBW. The thought, discussed by a gathering of engineers brought together during the conference by James Schultz, chief engineer of station WCAE, is that such an organization could perform a valuable service by improving the status of engineers and functioning as a sort of mutual benefit society. Idea would be to gain with station management better recognition for engineers and their accomplishments. Engineers who are interested in the formation of an organization have been invited to write to engineer Schultz and state their views.

RMA Committee Reports on Production Problems

In a dramatic presentation entitled "The Radio Industry Reports to OPA—Six Months After VJ Day," a special committee on Industry Production Problems of the Radio Manufacturers Association reports production difficulties encountered by producers of certain component radio parts, and by the set manufacturers themselves.

The report indicates that during the last quarter of 1941, the industry, with 54 licensed manufacturers, turned out 3,581,000 radio sets worth $80,235,000. As of VJ Day the industry had 141 set manufacturers who in 1944 had produced $2,834,000,000 worth of radio and related material.

The widely publicized statement of three and one-half to four million radio sets predicted for last Christmas by the WPB is prominently mentioned in the report and the actual production of "less than 300,000 sets—including an undetermined number of so-called 'morale' sets built under priorities for the U.S. Government," is disclosed.

Emphasizing throughout its report that competition is not only the practical way to production but also the surest price leveler, the committee cites some interesting statistics to support its claims.

Between 1922 and 1939 there were

(*Continued on page* 134)

Conventions and Meetings Ahead

Society of Motion Picture Engineers (J. Haber, Hotel Pennsylvania, New York); Fifty-ninth Semi-Annual Technical Conference, May 6 to 10, 1946, Hotel Pennsylvania, New York City.

Acoustical Society of America (Wallace Waterfall, Celotex Corp., 120 So. LaSalle St., Chicago, Ill.); May 10 to 11, New York.

American Institute of Electrical Engineers (H. H. Henline, 29 W. 39th St., New York); Southeastern Dist. Meeting, May 13 to 16.

Radio Parts and Electronic Equipment Conference and Trade Show (Kenneth C. Prince, 221 No. LaSalle St., Chicago, Ill.); May 13 to 16.

Institute of Radio Engineers, Chicago Section (135 So. LaSalle St., Chicago 3, Ill.); May 17.

American Society of Mechanical Engineers (Ernest Hartford, 29 W. 39th St., New York, N. Y.); Semi-Annual Meeting, June 17 to 20, Detroit, Mich.

American Society for Testing Materials (260 So. Broad St., Philadelphia, Pa.); Forty-ninth Annual Meeting, June 24 to 28. Buffalo, simultaneously, Seventh exhibit of testing apparatus and related equipment.

Society for Experimental Stress Analysis (W. M. Murray, President, Central Square Station, Cambridge 39, Mass., Post Office Box 168); Spring Meeting, June 24 to 26, Hotel Statler, Buffalo, N. Y.

American Institute of Electrical Engineers (H. H. Henline, 29 W. 39th St., New York); Summer Convention, June 24 to 28, Detroit. Pacific Coast Convention, Aug. 26 to 30, Seattle.

Instrument Society of America (L. Susany, Secretary, Carnegie Institute, 4400 Forbes St., Pittsburgh); 1946 Exhibit and Conference, Sept. 16 to 20, Pittsburgh, Pa.

National Electronics Conference, October 3, 4 and 5, 1946, Edgewater Beach Hotel, Chicago.

Television Broadcasters Association, Inc. (500 Fifth Avenue, New York 18, N. Y., Room 1038, Will Baltin, Secretary); Conference, October 10 and 11, Waldorf-Astoria Hotel, New York City.

American Welding Society (Miss M. M. Kelly, 29 W. 39th St., New York, N. Y. PE 6-9220); Annual meeting, October 24, 1946, New York City, and November 17 to 22, Atlantic City, N. J.

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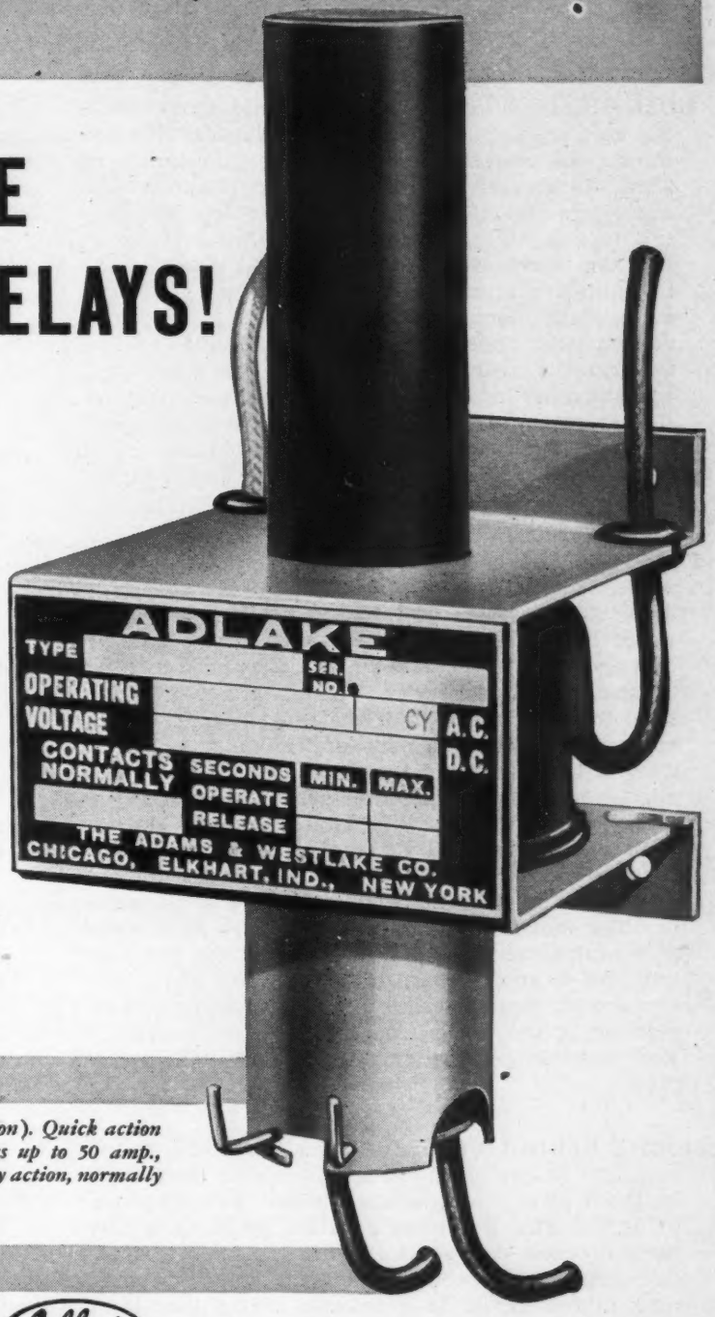

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WASHINGTON

★ ★ ★ Latest Electronic News Developments Summarized by *Electronic Industries'* Washington Bureau ★ ★ ★

GOAL OF 22 MILLION SETS—The radio manufacturing industry has set its sights for volume production during the remainder of 1946, with an estimate of 21,981,810 receivers, including 85,000 adaptors and converters and 677,050 sets for export, contained in the replies furnished to the FCC's recent survey. In order to achieve this goal, the radio manufacturing industry must be well freed of the price and materials bottlenecks which have clogged its reconversion path since V-J Day. The FCC or any other Government agency cannot expect the impossible without relief from these obstacles. During May and the remaining seven months of this year volume production at well over 2 million sets per month has to be achieved, since only an estimated 4 million receivers were produced in the first four months.

FM SET PRODUCTION SMALL UNTIL STATIONS ON AIR—Manufacturers' estimates of 1946 output of only 1,800,000 FM receivers, of which almost all would be combination AM-FM sets, were distinctly disappointing to the FCC in its hopes of launching this new broadcast service. The Commission emphasized that "in the light of the rapid progress being made for the development of FM on the station side" it hoped manufacturers may revise their production schedules to include a greater portion of FM receivers. But the manufacturers naturally do not want to "put the cart before the horse" and when there is widespread FM broadcasting service the industry will produce the receivers desired by the public. The industry can convert in a very short time to manufacture great quantities of FM sets, but does not wish to go overboard until there is a real public demand for these receivers and FM broadcasting also gets out of the woods from the new CPA construction limitations on new transmitter and studio buildings.

MOBILE RADIO LICENSES—To insure stability of investment in equipment and to stimulate operations in the highway and urban mobile radiotelephone fields, the FCC has recognized the problems of the users of these new services—bus, trucking, taxicab, etc., companies, as well as telephone companies planning to furnish it. It is realized that a long-term license period under experimental grants (five years now being considered) and relaxed experimental authorization to permit commercial utilization are necessary and the FCC considered effectuation of this program. This would give the Commission a "breathing spell", in view of its tremendous load of AM-FM-TV broadcasting case docket, to postpone hearings on its future policies regarding operation and regulations of the mobile services—particularly the issue of whether telephone companies or bus-truck-taxicab groups should operate, or a combination of both.

LARGE FIELD IN MOBILE SERVICES—Radio manufacturers are aware of the potentialities in this field. FCC furnished ELECTRONIC INDUSTRIES with recent compilation of applications for March only which comprised 43 taxicab, ambulance companies, detective agencies, customer-driven automobile companies proposing as many land stations and 650 portable-mobile units. With OPA taking off price controls from transmitters, FCC feels "flood just starting". Bell System and Independent telephone companies, likewise, have filed large group of mobile applications, including one interesting experiment by a Michigan Independent for carrier radiotelephone service. Leading manufacturers, which are to furnish equipment, include RCA, Federal Telephone & Radio, Galvin, Link, General Electric, Western Electric, and Communications Equipment Co.

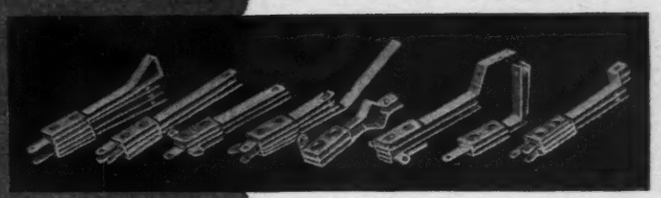
RAILROAD RADIO ON MARCH—Important departure in licensing policy in railroad radio field was made by FCC in authorization of Aireon to engage in experimental operation of inductive service radiotelephone with moving trains. Commission prognosticated new licensing regulations and standards to obviate barriers under present "low power" rules, designed to prevent interference from so-called radio "gadgets" such as mystery control and phonograph oscillator devices. New policy expected to stimulate inductive carrier method on railroads. Besides Aireon, this system has been pushed by Union Switch & Signal which is making a $1 million installation on Pennsylvania Railroad. Another experiment, interesting to FCC, was Farnsworth's use of a satellite transmitter technic at its demonstration near Detroit. Telephone service to passengers on moving trains also has been launched by Chesapeake and Ohio Lines on its Pere Marquette railroad.

MISCELLANY—Congressional deliberations on Bamberger television tower location controversy in Washington are interesting guidepost for future situations in other cities. . . . Amateurs are coming back on air in large numbers; "hams" with 2,655 applications led all other services in March. . . . Comprehensive state-wide networks of educational FM stations in 32 states, projected by U. S. Office of Education and state school departments. . . . RCA demonstration of "air-borne television" with its potentialities for industrial use attracted interest of high Government and military officials.

National Press Building
Washington, D. C.

ROLAND C. DAVIES
Washington Editor

Switches OF TOMORROW FOR DESIGNS OF TODAY



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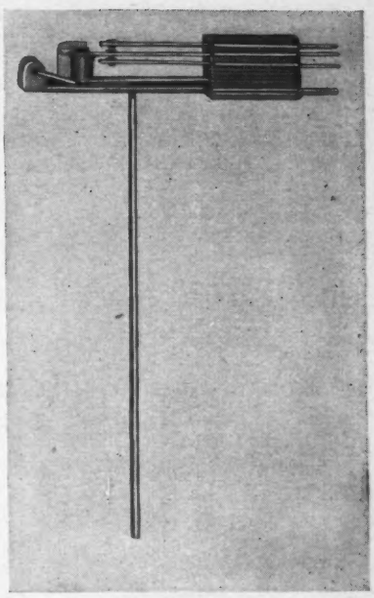
You are invited to visit Guardian's Booth, No. 51, Radio Parts and Electronic Equipment Trade Show, May 13-16, Stevens Hotel, Chicago



GUARDIAN FEATHERUB SWITCH

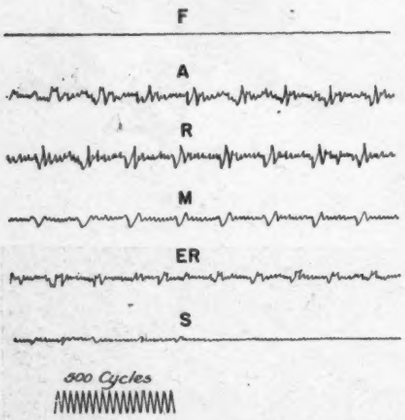
GUARDIAN ELECTRIC

1622-F W. WALNUT STREET CHICAGO 12, ILLINOIS

NEW PATENTS ISSUED

Voice Transmission System

It is claimed that voice currents are of a repetitious nature, as illustrated in the first figure for the word "farmer" which apparently consists of six different sounds. Each sound in turn is composed of one or more sets of repeated waveforms in continuous sequence. Based on this statement, the invention proposes to transmit only



characteristic sections of the repetitious voice currents that correspond to each sound—one-tenth is mentioned as a suitable value—and to simultaneously reduce the frequency by the same factor. The transmitted signal will then occupy only one-tenth the audio frequency range but it will take up the same length of time as the original signal. At the receiver the frequency is increased by the same factor and the eliminated sections reinstated by repeating each portion as many times as the signal is a fraction of the original signal at the transmitter.

The system permits reduction in the transmitted audio frequency band by a factor of 10 in the above example. It also provides for secrecy because only a receiver of the same frequency multiplying and repetition rate as the transmitter would reproduce intelligible voice currents.

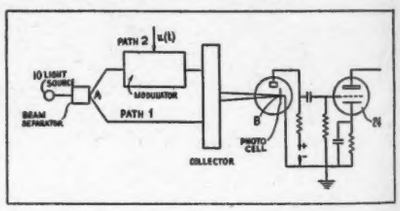
A particular apparatus for the realization of this method is claimed and illustrated in the second figure. It involves magnetically recording the voice signal on a rotating tape 38 by means of a conventional recording head 40. The pick-up coils 46, 48 and 50 connected to the output are rotatably mounted and in contact with the tape 38 only while moved outward by the stationary cam bar 76 so that at any one instant only one of the pick-up heads takes off signals from the recording tape. Each pick-up is short-circuited by switch 66 when out of engagement with the tape.

The pick-ups rotate at nine-tenths the peripheral speed of the recording tape. Consequently the signal frequencies taken off the tape are one-tenth the recorded signal frequencies, however, nine-tenths of the signal will be eliminated. The message on the tape is wiped off by means of the electromagnet 96. At the receiver, the pick-up heads and the recording tape rotate in opposite direction, the pick-up heads with a speed that is nine times that of the recording tape.

T. W. W. Holden, The Magnavox Co., (F) August 19, 1942, (I) October 30, 1945, No. 2,387,906.

Modulation by Means of Light Interferences

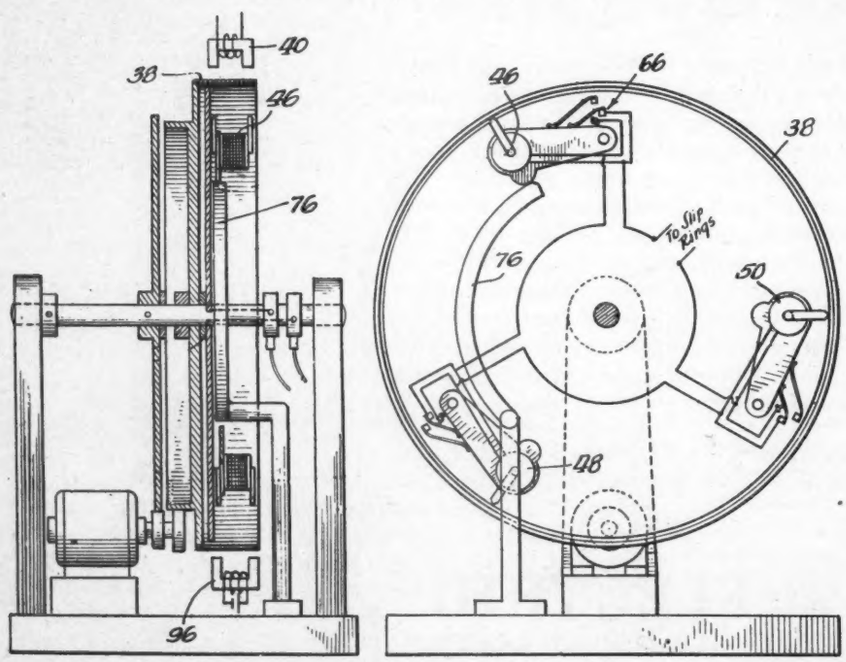
It is known that, due to interference, the light intensity I of two superimposed, coherent, monochromatic rays emitted by the same source, will be equal to $I = 2i\,(1 + \cos 2\pi d/\lambda)$, where i is the intensity of the component rays, λ the wavelength, and d the difference in the equivalent optical path length traveled by the two rays between the point of separation A and the point of superposition B. If the difference in effective optical path is linearly controlled by a signal $u_{(t)}$, the light intensity I of the combined rays will be equal to the cosine of a constant factor times $u_{(t)}$; in other words, the light intensity will be frequency modulated.



The patent describes various methods of changing the effective optical path length to obtain frequency modulation of the light intensity which is then converted into a frequency-modulated electrical signal by means of a photocell. A schematic representation of this system is shown in the figure. It is claimed that a comparatively wide linear frequency deviation may be effected by the principle of light interference; a change in effective path length of one millimeter corresponding to a frequency change of 16,000 radians for violet light.

The effective optical path length may be varied by moving a reflecting mirror actuated by a relay or by a bilaminar interferometer where one or both of the laminate are made of piezo-electric material and the signal voltage is applied to the crystal faces, the thickness of the lamina in the direction of light passage then causes varia-

(*Continued on page* 136)



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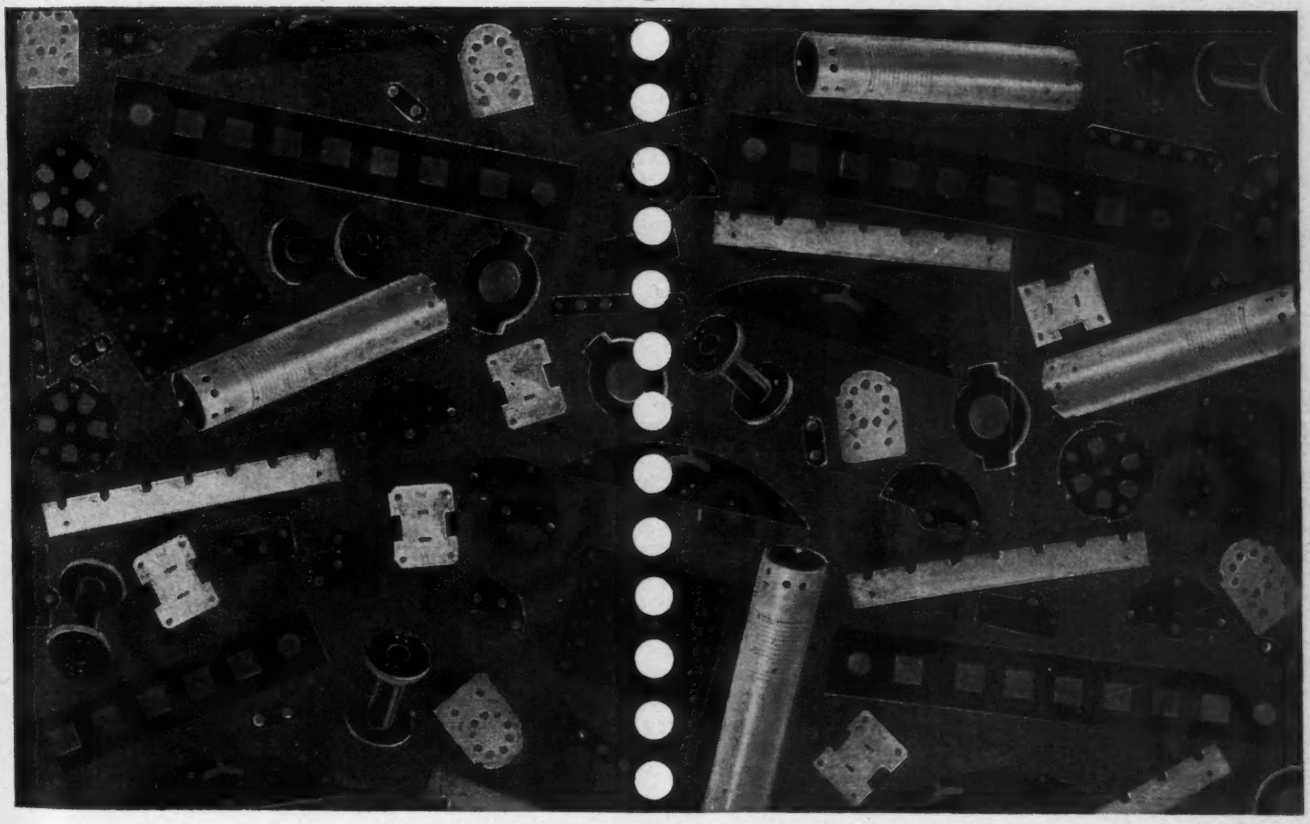

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★ TELEVISION TODAY* ★

New Developments in the Video Field

Westinghouse Granted Color Tele License

First licenses to embody CBS' ultra-high frequency color inventions in television receivers and studio apparatus have been granted to the Westinghouse Electric Corp. Arrangements, on a patent royalty basis, are for five years and provide for an extension of the agreement. Royalties to CBS range from 25 cents to one dollar on receiving sets, depending on the retail price, and one per cent of the net selling price of complete color television transmitter studio apparatus.

The scale of royalties on color television receivers and combinations provides that sets made by the licensee to be sold at a retail price of less than $100 will yield a royalty of 25c each; those from $100 to $180, a 50-cent royalty; from $180 to $250, a 75-cent royalty; from $250 and up, a $1 royalty unless and until the U. S. Department of Commerce Combined Index of Retail Prices (or the Bureau of Labor Statistics Cost of Living Index) rises 25% or more from the January 1, 1945, level. Thereafter, if CBS gives the licensee three months' prior notice, the contract calls for a royalty of one-third of one per cent of the proposed retail price.

UNO Council Opening Televised

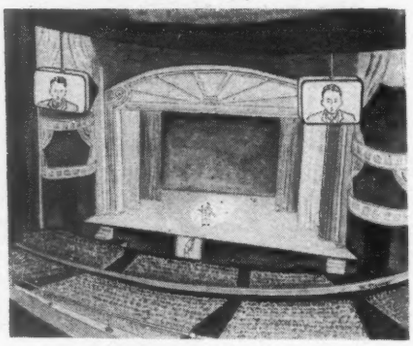
When chairman Dr. Quo Tai-chi of China opened the first United Nations Security Council conference on United States soil on March 25, a complete television pickup and receiving system swung into action to bring proceedings of the meeting to representatives of press and radio at Hunter College and in the Radio City studios of the National Broadcasting Co. The combined facilities of NBC Television and the RCA Victor Division of the Radio Corp. of America were used to make this closed-circuit television pickup possible.

Using the super-sensitive RCA Image Orthicon camera tube, the installation at Hunter College was designed to facilitate press and radio news coverage of world events. Wired television carried the signal from a special booth overlooking the Council chamber to twelve RCA receivers in a special viewing room for the press adjoining the Council chamber. A radio-relay transmitter sent the picture signals from UNO headquarters to Radio City where they were flashed on six more television receivers placed by NBC Television in studio 8-G.

*Title registered U. S. Patent Office.

DuMont Adds

Allen B. DuMont Laboratories, Inc., Passaic, N. J., is preparing for considerable expansion. About September 1 a new plant at 1000 Main Avenue in Clifton, N. J., will be occupied and will be devoted to the manufacture of oscillographic instruments and television receivers.



Intra-Auditorium Vision Relay

For the convenience of remote audiences where people are in large auditoriums, theatres, and even outdoor assemblies, the intra-auditorium vision relay will do for the eye what the Public Address system now does for the ear, reports W. S. Stewart, Editor, International Photographer.

Eventually, the physical dimensions of such vision relay equipment may be reduced to the point where it is portable in the same sense that public address systems are portable today. Motion picture exhibitors might relay, for short intervals, portions of the films being screened inside to a screen in front of the theatre. This could supplement the marquee as a patron "teaser". Commercial development of such a system will make opera glasses obsolete, as well as create new jobs in the manufacture, operation and maintenance of equipment.

Six Tele Companies Cover Bomb Test

Television will join with other public information media in covering the atomic bomb test, "Operation Crossroads," off Bikini Atoll sometime in May. The telecasters have received permission from Joint Task Force One to send a cameraman to "Operation Crossroads" to film the event for television viewers in New York, Chicago and Philadelphia.

The six tele-participants in "Operation Crossroads" are the Columbia Broadcasting System (WCBW), New York; American Broadcasting Co., New York; Balaban & Katz Corp. (WBKB), Chicago; Allen B. DuMont Laboratories (WABD), New York; National Broadcasting Co. (WNBT), New York, and the Philco Radio and Television Corp. (WPTZ), Philadelphia.

All film made by the tele-cameraman will be forwarded through official channels to the U. S. Navy Photo Science Laboratories in Anacostia, D. C., for developing and security screening. Film approved will be turned over to the television pool for screening and selection of individual footage by participants.

Philco Withdraws in Philly-Wash

Following the decision of FCC to allot the nation's capital's fourth television channel to DuMont, Philco has withdrawn its application both there and in New York and henceforth will operate only its Philadelphia Station WPTZ. DuMont already is operating a low power experimental station in Washington, expected to have its high power commercial station there in operation coincidentally with the opening of its New York Wanamaker studios.

WBKB Switches Channels

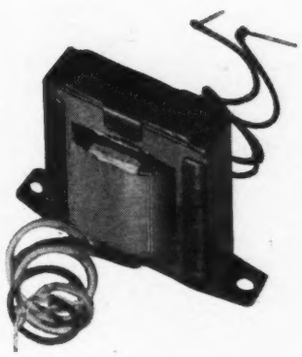
First of March the Balaban & Katz television station WBKB shut down for a two-week period to make technical adjustments incident to the switch from its present channel No. 3 to channel No. 4. The new assignment is in the 66-72 mc band.

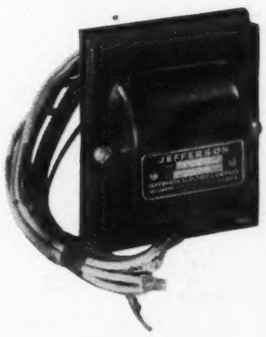
OIL HEATING — LIGHTING — RADIO — ELECTRON

• SPECIFICATIONS •

"Write Jefferson Electric Transformers"

INTO YOUR RADIO AND ELECTRONIC EQUIPMENT SPECIFICATIONS





Economical, trouble-free transformer performance is important to every user. And the savings of unnecessary trips, delays and replacements are important to every manufacturer and dealer of radio, radar, television and electronic devices.

Jefferson Electric Transformers incorporate advancements in engineering design, with production methods and control to insure high uniform quality.

The superiority of Jefferson Transformers is based on such vital and fundamental quality characteristics as: improved steel to reduce electrical losses; advanced methods of using carefully selected iron for laminations followed by Jefferson's own process of annealing; improved compounds, materials and impregnation methods to provide greater resistance to moisture, extreme heat and cold.

In addition to these features, full control over all manufacture, assembly and inspection insures that every Jefferson Transformer is laboratory correct whether ordered in small lots or hundreds of thousands.

When making transformer replacements or considering new installations—select your transformers from the Jefferson Electric Line . . . JEFFERSON ELECTRIC COMPANY, Bellwood (Chicago Suburb), Illinois. *In Canada:* Canadian Jefferson Electric Co. Ltd., 384 Pape Avenue, Toronto, Ont.

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TRANSFORMERS

WHAT'S NEW

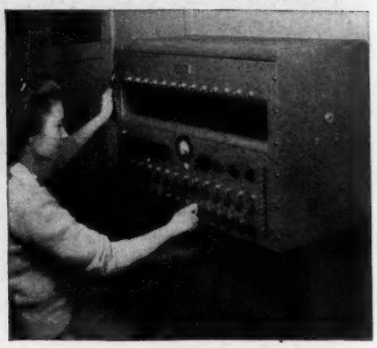
Devices, products and materials the manufacturers offer

DC Relay

Barber-Colman Co., Rockford, Ill., has developed the Micropositioner, a highly sensitive polarized dc relay having a floating neutral position of contacts. It is designed for use in plate circuits of electronic systems. Alnico permanent magnets are used and contacts are platinum-ruthenium. Two models are available, a voltage sensitive and a current sensitive type.—Electronic Industries

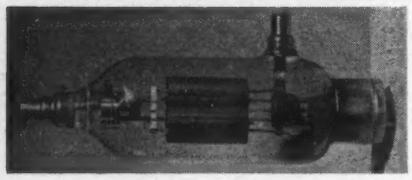
Aircraft Receiver

An aircraft range receiver model ARR-1 is now in production at the electronics Division of Maguire Industries, Inc., Bridgeport, Conn. The set weighs 3 lbs 10 oz, complete with tubes and batteries. Model ARR-1 covers the radio range from 190 to 420 kc and is provided with a voice filter permitting reception of tower instructions and weather reports.—Electronic Industries



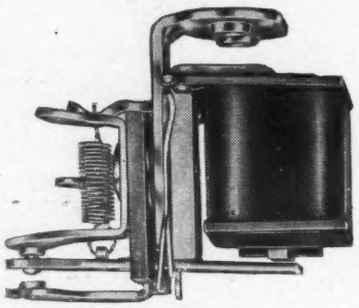
Electrical Computer

A computer for solving linear simultaneous equations up to and including twelve based on the "Gauss-Seidel" method has been developed by Consolidated Engineering Corp., 620 North Lake Ave., Pasadena 4, Cal. Originally designed for mass spectrometer and infra-red data, its application extends to any other field involving simultaneous equations, such as electrical circuits. The instrument is operated from the 115 v., 50-60 cycle ac line and is unaffected by normal voltage fluctuations. It consumes 100 watts.—Electronic Industries



Power Triode

A new air-cooled triode using a heavy graphite anode will handle 400 w of power output at a frequency up to 60 mc. Plate voltage is 2000 v dc with a terminal at the top of the tube. The grid is brought out at the side of the envelope. It was designed by Lewis Electronics, Los Gatos, Cal., primarily as a unmodulated class C rf amplifier.—Electronic Industries

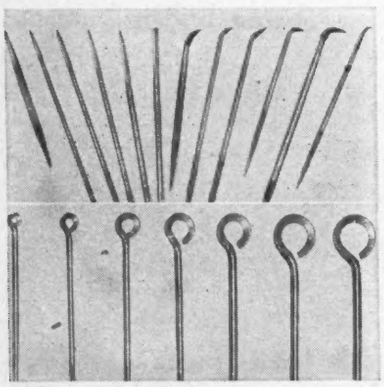


Midget Relay

Series 13, a line of midget relays having a sensitivity of .035 watt for low current operation under limited space and weight conditions has been developed by Kurman Electric Co., 35-18 37th St., Long Island City, N. Y. The relay is housed in a compact 1 oz. unit, has balanced armature construction. The contacts are single pole, double throw and are rated to carry ¼ amp., 110 v. ac.—Electronic Industries

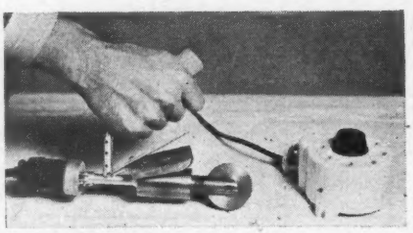
Baking Enamel

Successfully completed tests on the bases of transmitting tubes with a new high-grade baking enamel called "Porciflex," developed by H. V. Walker Co., Elizabeth, N. J., indicate this new paint to be valuable in speeding up production in all industries using organic finishes on metal. "Porciflex," when applied to metal, gives a flexible porcelain-like finish, which has very high resistance to acids, alkalis, oils and greases. —Electronic Industries



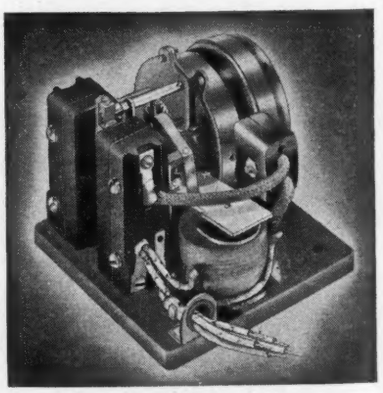
Deburring Tools

Seven distinct types of hand-forged deburring tools suitable for non-ferrous hard metal work or plastics are being manufactured by Metal Products Co., South Bend, Ind. The tools are hand-propelled and may be had singly, unassembled or in ready-made complete sets with handles.—Electronic Industries



Heat Sealer

Sta-Warm Electric Co., Ravenna, Ohio, has developed a pistol-grip heat sealer considerably changed from the present line of electric heat-sealing equipment. The unit is rated 1.5 amps., and is available for 110 or 220 v. ac or dc as specified. Rheostat control with 150 temperature settings is provided. The bronze alloy sealing roller is self-lubricating.—Electronic Industries



Time Delay Relay

A relay providing from one to ten minutes time delay after actuation of the relay coil has been brought out by Price Electric Corp., Frederick, Md. The standard relay is equipped with two snap action switch units, one for controlling the motor and the other providing a single pole double throw contact combination. The relay contacts are rated up to 10 amps. at 115 v. ac, non-inductive load. It is designed for 115 v. ac, 60 cycles.—Electronic Industries

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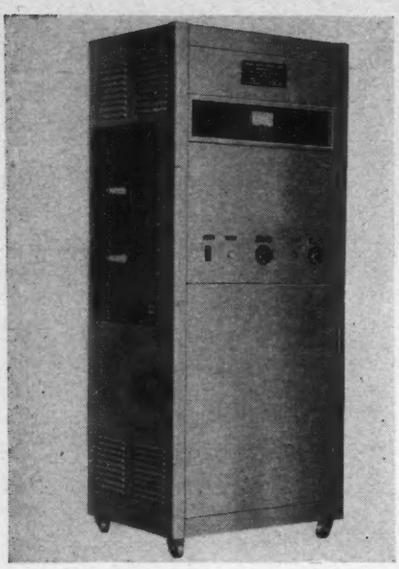
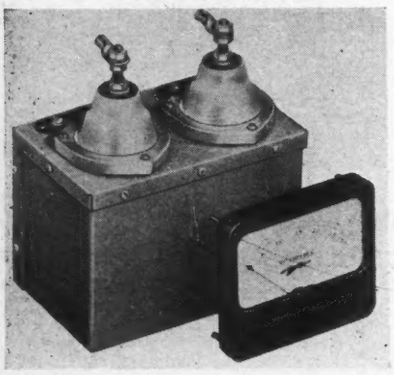


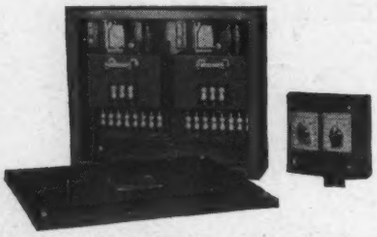
Insulation Tester

A new test cabinet furnishing 50,000 v dc at 10 ma, is designed for insulation testing and determining the breakdown voltage of various materials and components. Output voltages are continuously variable over three ranges. Operation is from 115 v ac with power consumption of about 1 kw. Manufactured by Radio Development Labs., 362 Atlantic Ave., Brooklyn 2, N. Y.—Electronic Industries



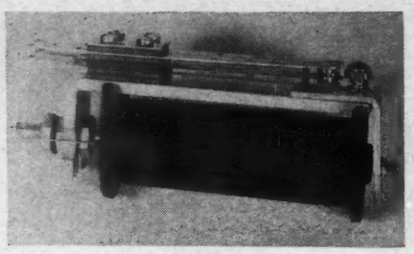
Antenna Ammeter

An electronic remote antenna ammeter has been developed by Andrew Co., 363 E. 75 St., Chicago 19, Ill., using a remotely controlled dc microammeter actuated by a current transformer feeding a diode-rectifier tube located at the antenna.—Electronic Industries



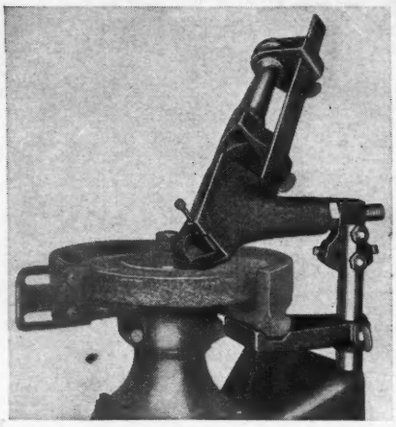
Repeat-cycle Timer

A new unit that will control two adjustable timing periods running in a continuous cycle has been designed by Photoswitch Inc., 77 Broadway, Cambridge 42, Mass. It will time periods between 1/20 of a second to two minutes with an accuracy better than 2%.—Electronic Industries



Communication Relay

A new telephone type relay, being made by Standard Electrical Products Co., 400 Linden Ave., Dayton 3, Ohio, has a ball bearing armature pivot. It also features heavy silver contacts operating under high contact pressure. Sensitivity is 1/10w.—Electronic Industries

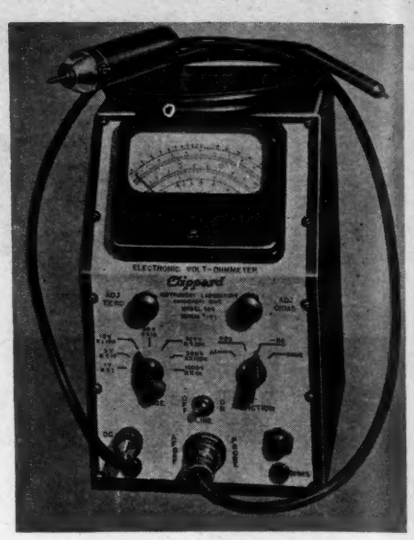


Drill Grinding

Two new drill grinding jigs for precision usage are being made by Industrial Mfg. Co., 1900 Euclid Ave., Cleveland, Ohio. These fixtures will handle all sizes of drills from 1/4 to 2 7/8 in., in diameter and up to 26 in. long. Machine grinding is not only faster than hand grinding; but because of more accurate control of face angles, a precision ground drill will cut quicker and cleaner.—Electronic Industries

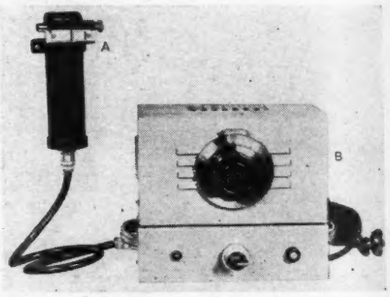
Mobile Welder

For quick and easy arc-welding on jobs which cannot be brought to the welding shop, Willys-Overland Motors, Inc., Toledo, Ohio, is making one model of the civilian jeep with a built-in arc-welding unit. The generator for the welding unit is powered by the regular jeep engine which uses only slightly more than 1 gal. of gasoline per hour of operation. The generator will handle welding rods up to 1/4 in.—Electronic Industries



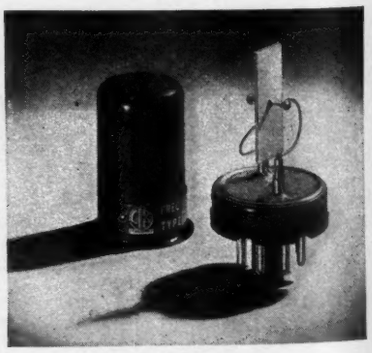
Volt-Ohmmeter

A compact laboratory type electronic volt-ohmmeter model 406 with extreme range using a bridge type circuit is in production at the Clippard Instrument Laboratory, Cincinnati, Ohio. Four tubes are used in the instrument and a large D'Arsonval type meter of 200 microamperes sensitivity is provided. Seven ranges cover 0 to 1000 volts ac or dc, and 0 to 1000 megohms resistance.—Electronic Industries



Exposure Control

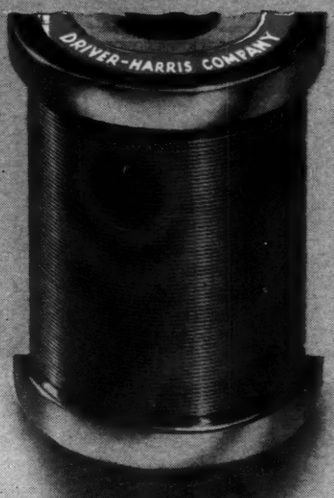
A control for automatically measuring accumulated exposure for photographic printing installations is being made by Electric Eye Equipment Co., Danville, Ill. Uneven light intensities are compensated for by varying the length of exposure time.—Electronic Industries



Quartz Crystal

A quartz crystal mounted in a new type of metal tube shell is being produced by the James Knights Co., Sandwich, Ill. The available frequency range for the JK T9AD unit is les than .01% over a temperature range from —50 deg. C to +75 deg. C.—Electronic Industries

There is a DRIVER-HARRIS ALLOY for *Every Electrical* Resistance Requirement

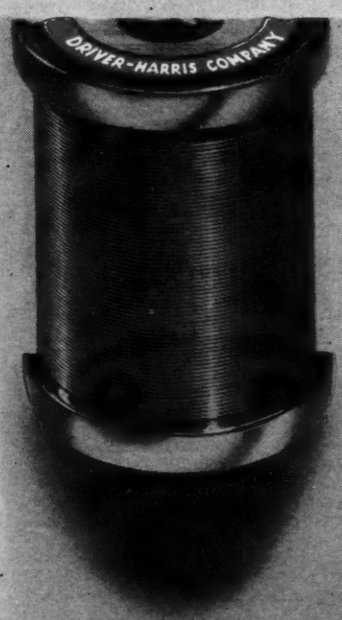


NICHROME* & NICHROME V for winding large value resistors where space factors call for compactness in design without sacrificing dependability. Available in all shapes and sizes drawn down to the extremely fine gauge of .001" diameter—67 miles to the pound.

MANGANIN for precision bobbins, Wheatstone Bridges, Decade Resistance Boxes, Potentiometers and National Bureau of Standards type resistance standards which require fixed stability and constant resistance under normally variable operating conditions and negligible thermal e.m.f. against copper.

Also the time-tested standard alloys for all vitreous enamel resistor requirements due to the complete absence of occluded gases. NICHROME V is particularly recommended when a more constant resistance at variable temperatures is specified.

ADVANCE* for winding precision resistors used in electric meters and laboratory testing devices. In finer sizes its negligible temperature co-efficient of resistance (±.00002) combined with high resistivity makes it the most desired alloy for this use.



In addition to these we manufacture over 80 different electrical *heat and corrosion-resistant* alloys. If your resistance requirements are different tell us about them and depend on it... Driver-Harris will develope the alloy best suited to your specifications.

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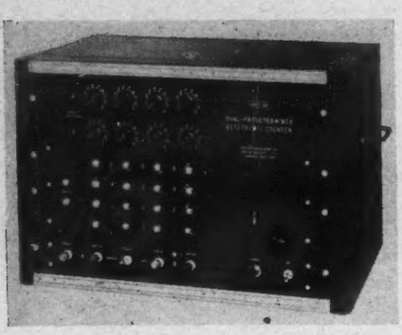
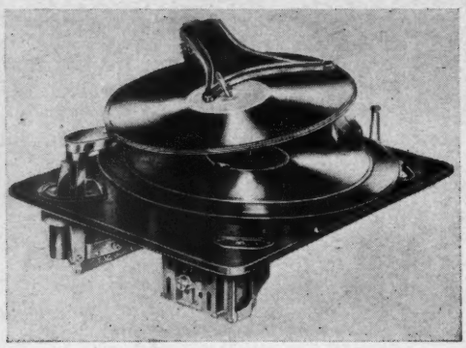


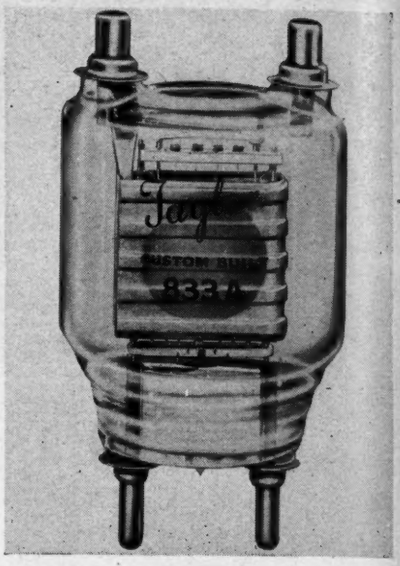
Electronic Counter

The usual ratio weighing process in the counting and packaging of small items can be eliminated by use of the Dual Predetermined Electronic Counter made by the Potter Instruments Co., 135-56 Roosevelt Ave., Flushing, N. Y. Operating from the 110 volt, 60 cycle power line the counter uses for counter-decade circuits arranged to give independent predetermining channels in which any number from 0 to 10,000 may be set up.—Electronic Industries



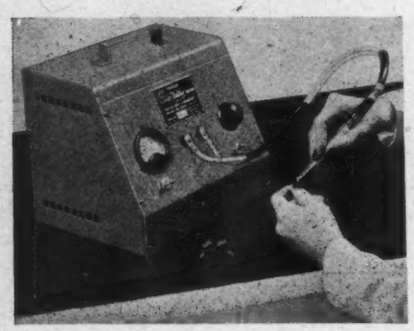
Record Changer

The record changer model RC 60 is available from the Garrard Sales Corp., 401 Broadway, New York. The Garrard changer may be had with a magnetic pickup or with a new one-ounce crystal cartridge. Mixed 10 in. and 12 in. records can be handled and a speed control for the governor-controlled motor is available.—Electronic Industries



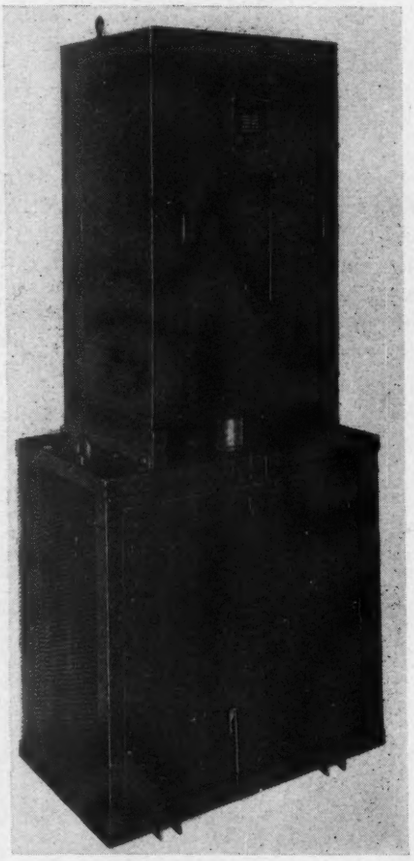
1600w Triode

Designed for use at frequencies up to 20 mc, Taylor Tubes, Inc., 2312 Wabansia Ave., Chicago, Ill., has a transmitting triode with a partially zirconium coated anode. Amplification factor is 10. Plate takes 4,000 v with a current flow of 0.5 a. Thoriated tungsten filament uses 10 v at 10 a.—Electronic Industries



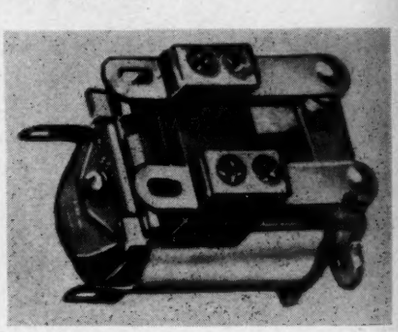
Spot Welding Machine

The Tweezer-Weld Corp., 280 Plane St., Newark 2, N. J., has developed the Besco tweezer spot welding machine, for small parts of .0005 in. to ⅛ in. round. With the forged copped tweezers, the electrodes may be applied directly to the elements to be joined. The device is designed for 115 volts, 60 cycle power supply and is operated by a foot switch.—Electronic Industries



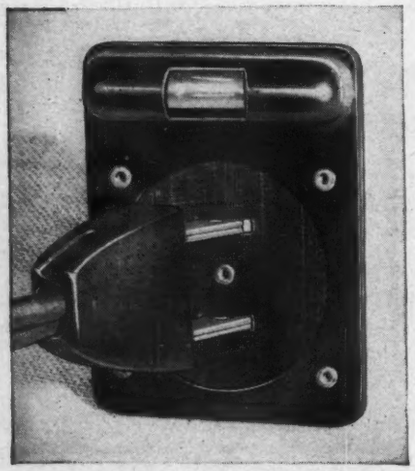
Power Factor Regulator

Modern Control Equipment Co., 176 W. Adams St., Chicago, has brought out the Haug system power factor regulator, which raises the power factor by taking the magnetizing current off the line. The regulator uses reactors and transformers of dry type construction and has no moving parts. It conforms with AIEE specifications and NEMA standards.—Electronic Industries



Control Relay

The "CR" type relay brought out by Allied Control Co., 2 East End Ave., New York 21, combines compactness and light weight and is more efficient on precision applications than larger and heavier power relays. The contact rating with ¼ in. silver contacts is 15 amperes at 24 volts dc or 110 volts ac. Two, three and four pole combinations are available.—Electronic Industries.

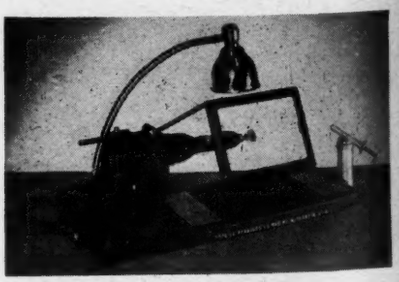


Pilot Light

Industrial Devices Inc., 22 State Road, Edgewater, N. J., has brought out the Handi-Glow plug-in pilot light, which indicates current flow through any electric outlet, socket or power cord.—Electronic Industries

Rhodium Plating

For all white plating applications Technic Inc., 39 Snow St., Providence, R. I., has available rhodium solutions, which are resistant to the corrosive action of all acids or combinations of acids and have 85% reflectivity.—Electronic Industries



Lathe

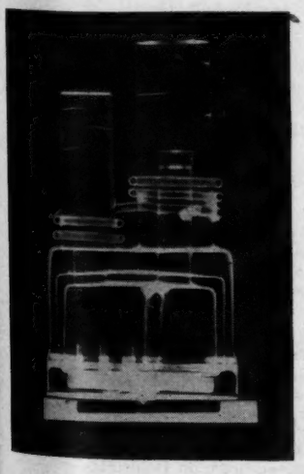
A small high-speed lathe has been developed by Precise Products Co., Racine, Wis., for use in grinding, finishing, and polishing small products made of steel, plastics, glass, wood and other materials. The Precise vari-speed lathe has a range of working speeds to 40,000 rpm. The power unit can be detached and used separately as a hand tool for grinding, milling, deburring and polishing.—Electronic Industries

Space Emptiers..

THE VMF SERIES—all-metal, high-vacuum pumps—empty space efficiently for a wide variety of purposes. Designed for use with automatic exhaust machines, these rugged, compact pumps are capable of reaching pressures of 10^{-6} and lower.

These are only a few of the many production jobs they help accomplish—

★ *Transmitter tubes* ★ *Electron microscopes*
★ *Cathode ray tubes* ★ *Trolley exhaust systems*
★ *Television tubes* ★ *Metal evaporation*
★ *Receiving tubes* ★ *Photospectrography*



THE sturdy, uncomplicated construction of the VMF Pumps (shown in the X-ray view)...their versatility... the variety of sizes available, air- and water-cooled ...their wide speed range ...all commend pumps of this series for both industrial and laboratory use. Priced from $45 to $135. Net f.o.b. Rochester, N. Y.

For complete details on the VMF Series High Vacuum Pumps, write—

Vacuum Equipment Division

DISTILLATION PRODUCTS, INC.

Rochester 13, New York

Transmitting Triode

A triode for use in television and FM transmitters requiring plate dissipation of 5 kw is being manufactured by Electronics Department, General Electric Co., Thompson Rd., Syracuse, N. Y. The tube can be used at frequencies up to 220 mc. The anode is water-cooled.—Electronic Industries

Air Driven Saw

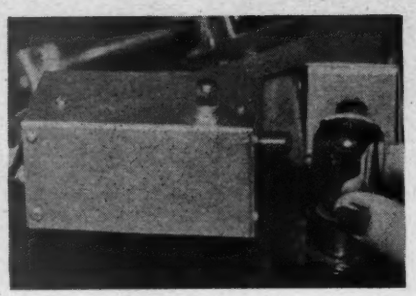
Using standard hack saw blades and files, a new air driven saw is being marketed by Air-Speed Tool Co., 1028 W. Slauson Ave., Los Angeles 44, Cal. Designed for any sawing or filing operation on thin metal, plastics or wood, the unit weighs only 3½ lb. The cutting stroke is adjustable from ¼ to 1¼ in. The tool operates on approximately 85 lb. air pressure.—Electronic Industries

Communications Amplifier

Bendix Radio, a Division of Bendix Aviation Corp., Baltimore 4, Md., has developed the MT-93 expressor amplifier for use in operating communications equipment from a noisy control point. Background noise up to 20 db is blanked out and the output level is maintained constant within 2 db by means of controlled expansion and compression. The overall gain is 80 db and the audio response is constant within 2 db between 300 and 3000 cps.—Electronic Industries

Silver Braze Flux

A new silver braze flux made by Sherman & Co., 197 Canal St., New York City 13, N. Y., forms a protective coating over the metal surfaces at 480 degrees F. At 800 degrees it is still water-thin and will flow in clearances as close as 0.001 in. Being neutral and non-hygroscopic it will not produce corrosion.—Electronic Industries

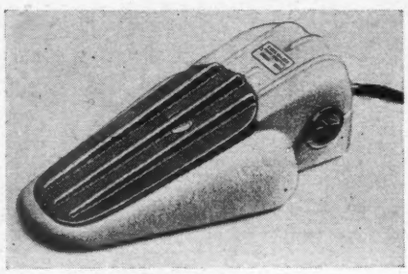


Automatic Tappers for Tube Testing

Solenoid operated tube tappers for the uniform control blows on electron tube envelopes to detect shorts, rf and audio noises have been developed by Sylvania Electric Products, Inc., Emporium, Pa. These automatic tappers provide six timed strokes at two points on the envelope and will eliminate the variation in test procedure resulting from the use of hand mallets by individual operators.—Electronic Industries

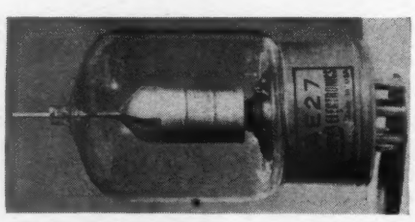
Carbon Brushes

An addition to the line of high speed electrographitic brushes is the 8800 series of carbon brushes manufactured by the Morganite Brush Co., Inc., 3302 48th Ave., Long Island City 1, N. Y. Designed to meet the trend toward higher peripheral speeds and higher current densities, their "open" texture permits close contact with the commutator for good riding stability. —Electronic Industries



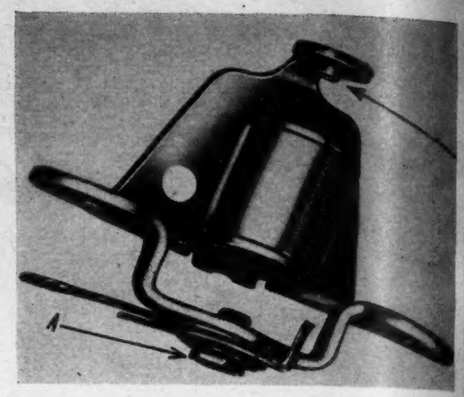
Foot Switch

The Time-O-Lite foot switch being manufactured by the Industrial Timer Corp., 117 Edison Place, Newark 5, N. J., incorporates a heavy duty single pole, double throw switch. Two outlets have each 1500 watts capacity. Another outlet of 1500 watt capacity turns the equipment off, when the switch is depressed. A pilot light is also provided.—Electronic Industries



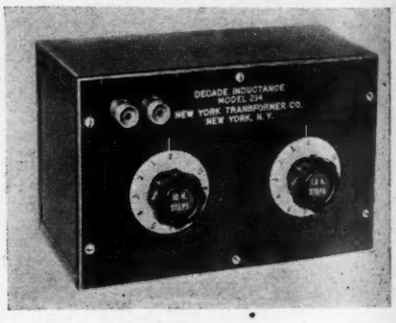
Beam Pentode

Lewis Electronics, Los Gatos, Cal., has developed a beam pentode for use as oscillator, power amplifier, modulator or amplifier-doubler. The manufacturer specifies power handling capacities of 200 watts output up to 75 mc and up to 80% normal input to 150 mc. It is possible to use the 4E27 simultaneously as power amplifier and electron switch by means of suppressor grid control.—Electronic Industries



Jewel Bearing Assembly

Marion Electrical Instrument Co., Manchester, N. H., has developed a jewel bearing assembly for D'Arsonval type instruments. The conventional screw settings and jewels are replaced by a metallized boro-silicate glass V jewel which is induction soldered in place. Through its use the overall size of the bearing assembly is considerably decreased. The hardness and performance of the jewel bearings is not affected by the metallizing.—Electronic Industries



Inductance Decades

For use in bridge and low-level filter circuits New York Transformer Co., 62 William St., New York 5, has developed a series of inductance decades. These units are triple shielded and have inductance ranges from .001 henry to 100 henries. The decades are adjusted to within 2% at 1000 cps. except for the 100 henry decade. The usefull frequency range is from 30 to 20,000 cps.—Electronic Industries

Electrical Connector

Expansion or contraction actuated by a special thread is the principle of the Williams Grip electrical connector developed by the AiResearch Mfg. Co., 9851 Sepulveda Blvd., Los Angeles 43, Cal. For emergency service one quarter turn by hand will make or break a connection. At 100 amps. the maximum voltage drop at the contact is 1.9 millivolts.—Electronic Industries

Rust Remover

A rust remover has been perfected by the Nox-Rust Chemical Corp., Chicago 8, Ill. It wets the metal, dissolves the rust scale, removes it and is relatively noncorrosive to steel even under conditions of long exposure.—Electronic Industries

Fluorescent Paints

Switzer Bros., 1220 Huron Rd., Cleveland 15, Ohio, have two fluorescent instrument lacquer colors for use on dial faces, tuning and switch controls and other apparatus which is operated under black light. These items are part of a complete line of fluorescent satins, paints, powders and writing materials and black light equipment for permanent and portable installations.—Electronic Industries

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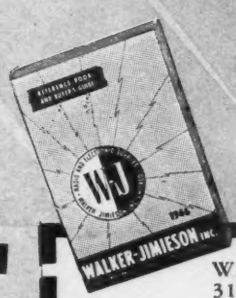

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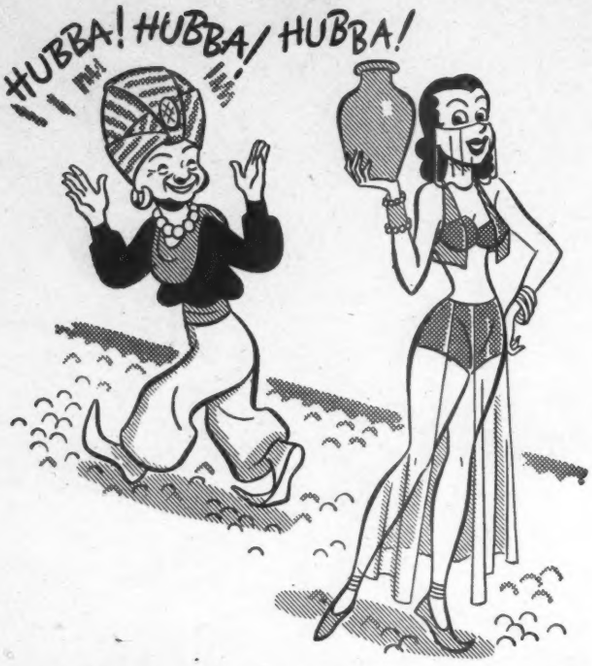

HUBBA, HUBBA, HUBBA!

(East Indian for "there's no substitute"... it's tops)

Of course we've heard the popular expression, "hubba, hubba, hubba!" — and perhaps Micah is only kidding when he tells us it's East Indian for "there's no substitute".

Hubba, hubba, hubba, or not, there is no substitute for mica where mica is needed. Nothing else possesses the high dielectric properties of mica, nothing else lasts so long. And while you're getting mica, there's no reason why you shouldn't get the best — for *Macallen Mica* costs no more.

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GUIDED MISSILS

(*Continued from page* 65)

voltage is regulated by means of gas regulator tubes, and the focusing current is held close to the design value of 0.8 amp. by a variable-resistance type current regulator. Still the regulation of current was found not sufficiently good to hold perfect focus under all conditions, and so a special focus-compensation circuit was developed in the conversion unit.

Operation of the circuit is based on the fact that there is a nearly linear relationship, over the range required, between focusing current and anode voltage for optimum focus. If the focusing current decreases, for example, focus can be restored by decreasing the anode voltage in the proper ratio, while an increase in focusing current will require a corresponding increase in anode voltage. Consequently, the focus can be maintained constant by using the change in focusing current to cause a change of the proper magnitude in the anode voltage.

By using a dc amplifier containing a triode controlled by changes in focusing current, the resulting change in voltage drop across the tube's load resistor is used to maintain focus. The elementary circuit is shown in Fig. 7. At normal cur-

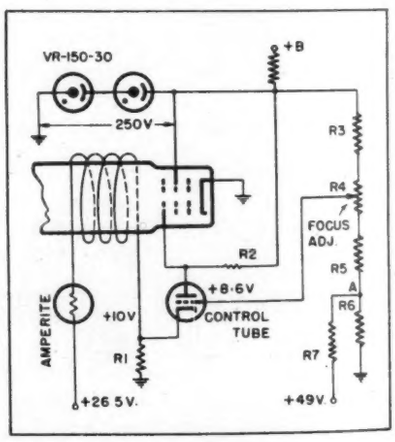
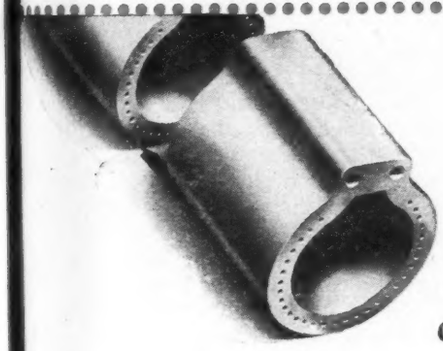


Fig. 7—Detailed circuit for automatic focus compensation

rent the voltage drop across R_1 is 10 volts, and to bring the control tube bias to the proper operating point (—1.4 volts) on its characteristic, the grid is connected to a voltage divider across the anode supply at a point 8.6 volts above ground. Actually the bias voltage is adjustable by means of R_4 so the latter serves as a focusing control. The resistance of R_1 must be constant under all temperature con-

Sometimes they are SIMPLER THAN THEY SEEM

EXTRUDED



CUT

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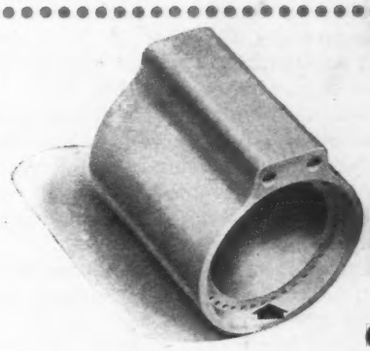
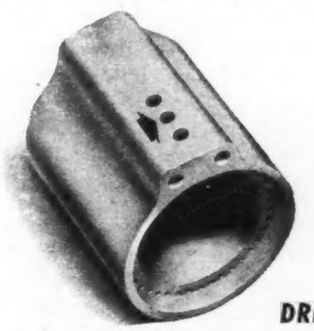
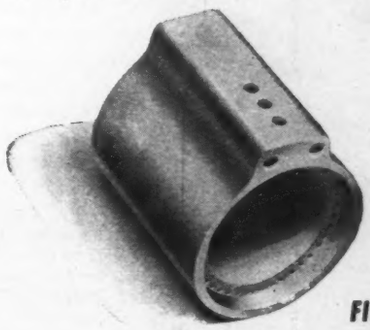


COUNTER-SUNK



DRILLED

4



FIRED

SOME intricate ceramic designs machined from steatite seem unbelievably complicated. Actually they are simpler than they seem. By incorporating complex design details in extruded, pressed or cast basic shapes, American Lava Corporation frequently has been able to minimize the relatively slow and costly machining process. Production study may show desirable design alternatives which permit faster deliveries, lower cost.

Here in one organization you will find engineering vision and practical knowledge of AlSiMag technical ceramics, backed by highly versatile equipment of our own design. Send us your unusual, intricate, or complicated designs. Perhaps we can suggest practical design simplifications and streamline manufacture by a combination of production facilities and experience available from no other source. *We like tough jobs.*

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Fifth Award December 2, 1944

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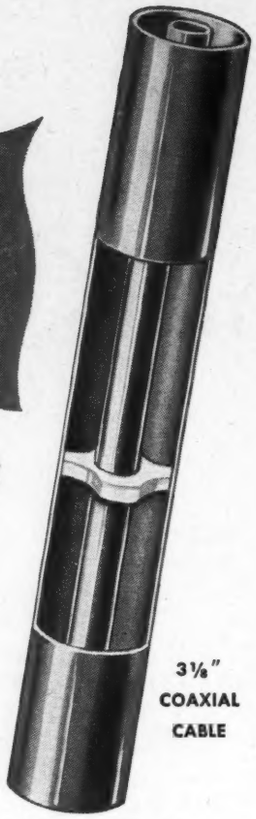


3⅛" COAXIAL CABLE

A new coaxial cable, especially designed for FM and TV use, is now a reality at the Andrew Co. Scheduled for mid-June delivery to the first orders received, these new cables, in 4 sizes, introduce the following important engineering features:

1. Characteristic impedance of 51.5 ohms. (The regular Andrew cables for AM applications have a nominal impedance of 70 ohms.)

2. Connectors and associated fittings have been engineered with special care to avoid reflections and discontinuities. Being completely solderless, these fittings simplify installation and eliminate problems of flux corrosion and pressure leaks.

3. Insulators are spaced 12 inches apart in the 3 large size cables, and 6 inches in the ⅞-inch cable.

4. Improved low loss insulation material is used, having a dielectric constant of 6.0 and a maximum loss factor of .004 at 100 mc.

5. Close tolerances have been established on conductor and insulator dimensions, in order to maintain a constant characteristic impedance.

6. Inner and outer conductors are made of copper having a minimum conductivity of 95% IACS at 25° centigrade.

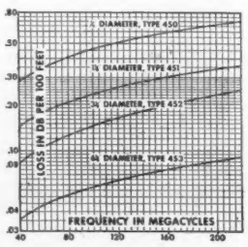
Your order now is the best assurance of early delivery on this new coaxial cable for your FM or TV installation.

Write or wire the Andrew Co., 363 East 75th Street, Chicago 19, Illinois, for complete information or engineering advice on your particular application.

6⅛" COAXIAL CABLE

ATTENUATION CURVE

Attenuation is calculated to provide for conductor and insulator loss, including a 10% derating factor to allow for resistance of fittings and for deterioration with time.



● The new 51.5 ohm air insulated coaxial cable for FM and TV comes in 4 sizes, priced tentatively as follows: ⅞", 42c per ft.; 1⅝", 90c per ft.; 3⅛", $2.15 per ft.; 6⅛", $5.20 per ft. Andrew Co. also manufactures a complete line of accessories for coaxial cables.

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ditions encountered, and so is wire wound and has substantially zero temperature coefficient.

The viewing lens has a focal length 50 millimeters, with a maximum relative aperture of f/1.9. The lens is in a mounting designed especially for this camera unit, and includes a lever-operated focusing adjustment on the front, a means for locking the focusing adjustment, and a pulley-operated adjustable iris that is automatically controlled by a motor to maintain correct light pickup intensity.

The optical path is normally closed by a sun shutter, mounted on the rear face of the lens recess. Two pivoted leaves, approximately semicircular in shape, are normally kept in the closed position by a spring, and are opened when the stand-by switch is thrown by means of a solenoid-operated plunger.

In the stand-by position, with the controlling switch open, this solenoid-operated sun shutter is closed, preventing possible damage to the pickup tube mosaic which might occur should the camera unit inadvertently be pointed to where the direct rays of the sun become focused on the mosaic. The iris control motor also is disconnected so that the iris diaphragm remains at the setting last used, since the control opens the lens iris to the maximum aperture when there is no video signal.

Automatic iris control

The automatic iris control uses a relay-operated reversible motor to operate the lens stop through a continuous flexible cable and pulleys. The motor (permanent-magnet field type) is mounted on a bracket on the rear panel of the unit. The iris control is sufficient to reduce the lens stop down to f/22 from the f/1.9 initial opening. The control operates from the rectified signal obtained from the video amplifier in the auxiliary unit. The mechanism is equipped with limit switches to prevent turning the lens iris beyond its limits of opening and closing. These are lever-operated microswitches operated by cams on the motor shaft.

Electrical heating coils are provided to maintain the temperature of the lens and face of the pick-up tube at a value high enough to prevent condensation of moisture with consequent deterioration or obliteration of the picture.

Setting of the video gain control is in general not critical, since the automatic iris control has much

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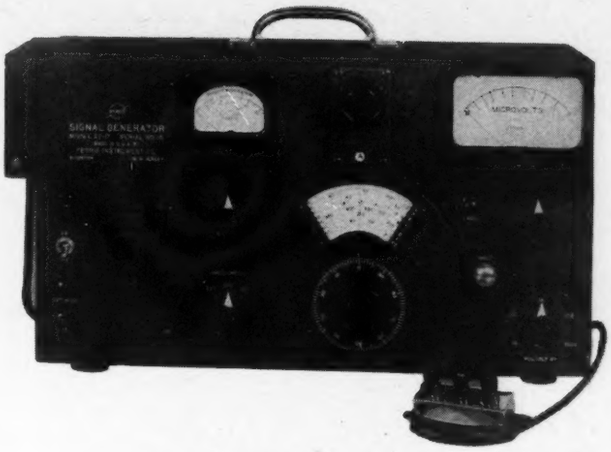
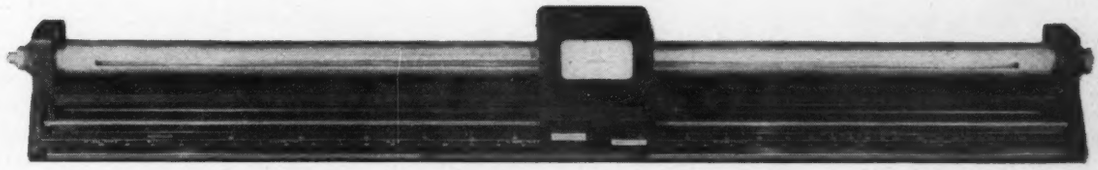


THE MODEL 22-D SIGNAL GENERATOR

Range 85 Kc to 40 Mc.

From a fraction of a microvolt to one volt.

The Model 22-D Signal Generator shown above is one of the new additions to the 22 Series. The wide frequency range covers I.F. and R.F. requirements for American and Foreign A.M. broadcast. Simplified operation, block type attenuator, and low impedance output, including three ohm tap for direct insertion into the loop or tuned circuit, are a few of the features of this new instrument.



The Model 446—A SLOTTED MEASURING LINE

For F.M. and Television work in the range from 50 to 500 Mc., the slotted measuring line is the answer to impedance measuring and matching. Write for details of this instrument and others to the

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the same effect as automatic gain control. The normal setting is between 70% and 100% of maximum gain. With a reflected light intensity of 20 foot candles from a conventional television test pattern of 50% contrast (equal areas of white and black), 85% modulation of the pedestal is secured.

The equipment is designed to modulate a type AXT-6 transmitter which requires a peak-to-peak signal voltage of 0.96 on a 0.6-volt pedestal. A synchronizing signal potential of from 4 to 7 volts (peak-to-peak) is required. Frequencies used in this service were at first 100 mc, later becoming 300 mc and up to 1,000 megacycles. The transmitter shown in Fig. 1 operates between 780 and 900 megacycles.

The primary source of power is a storage battery with a nominal terminal voltage of 26.5. Additional dc voltages required are 405 volts and —53 volts, both obtained from a dynamotor.

The weight of the camera pickup unit is approximately 20 lb. to which must be added the weight of the camera auxiliary unit, 10.25 lb., and that of the mounting bases and cables, the particular transmitter selected and a motor generator.

In mounting the camera pick-up unit care must be taken that there are no obstructions in the field of view of the lens. This requires a clear field (total) of 30° horizontally and 24° vertically.

PRODUCTION BRIDGE

(*Continued from page 73*)

inductance that can be read with any accuracy is 0.1 millihenry. The variable resistor is provided with a 6 in. dial calibrated directly in henries, subject to the position of the multiplier. The variable resistor is also semi-logarithmic and is directly calibrated in Q at 60 cycles, when the instrument is used as a Hay bridge, or when a transfer switch is thrown to the HI-Q position. When this switch is in the Low-Q position, the resistive balance is obtained by a decade capacitor. In either case the inductance is indicated on the main dial with appropriate multiplication factor.

The bridge arm resistors that have to carry the full dc applied to the inductance are amply rated. To be fully foolproof other resistors, which carry lesser currents, are protected with current-controlled

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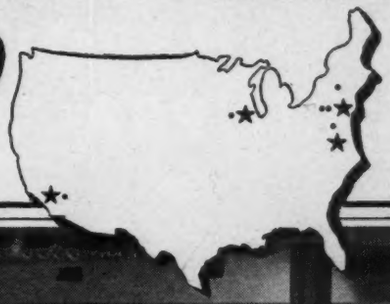

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When you consider television, you must think of Du Mont . . . for 4 of America's 10 operating television stations were designed and built by Allen B. Du Mont Laboratories, Inc. For no other company has pioneered the whole pattern of commercial station operation for the average station owner to follow. No other company offers the full backlog of its experience to prospective station owners.

See Du Mont equipment in action in the world's outstanding television installation, Du Mont's John Wanamaker Studios, in New York. Profit by Du Mont's experience in planning your television station. Write for our brass-tack booklet, "The Economics of Du Mont Television." We shall be very happy to mail it to you . . . please write on your firm's letterhead.

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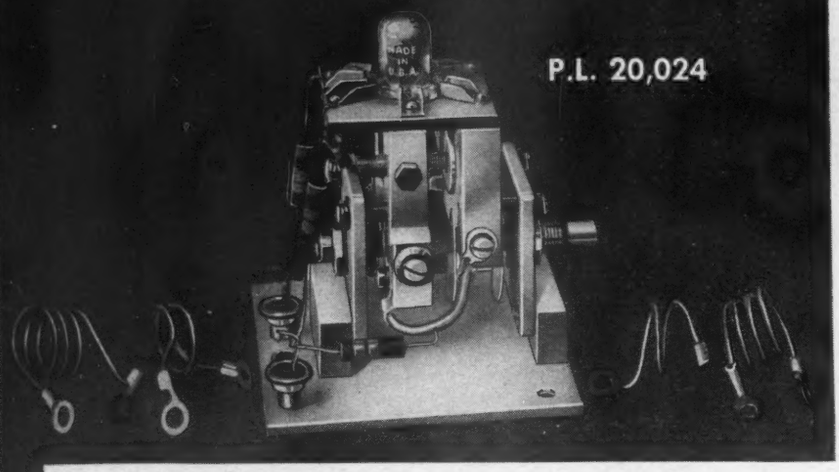
FOR IMPROVED V.H.F. PRACTICE

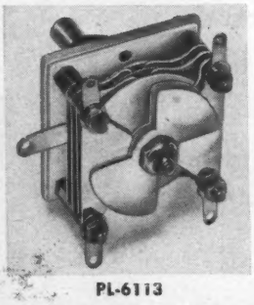


THE CARDWELL V.H.F. OSCILLATOR KIT

This kit includes 3 sets of coils covering 144-148 M.C., 220-225 M.C., 420-450 M.C. bands. (The 6F4 tube is not included.)

Ideally suited for local oscillator, for super-heterodyne receiver, as plate modulated oscillator for low power transmitter or transceiver, driver unit for amplifier tube in higher powered transmitter, V.H.F. signal generator, etc., etc.

A NEW LINE OF CARDWELL MIDGET CONDENSERS FOR U.H.F.



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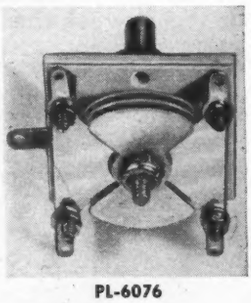
LOW DISTRIBUTED INDUCTANCE



PL-6076

CARDWELL V.H.F. 90 DEGREE TRIM-AIR MIDGETS					
Part List No.	Type	Max. Cap.	Airgap	Length Overall	List Price
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6076	ER-6-BF/S	6	.030"	$1^{57}/_{64}$"	2.70
6077	ER-8-BF/S	8	.030"	$2^{5}/_{32}$"	2.80
6078	ER-15-BF/S	15	.030"	$2^{15}/_{32}$"	3.40
6079	EU-25-BF/S	25	.020"	$2^{15}/_{32}$"	3.65
6080	EU-35-BF/S	35	.020"	$2^{19}/_{32}$"	3.80
**6081	EU-50-BF/S	50	.020"	$2^{31}/_{32}$"	7.65
*6113	ER-14-BF/SL	14	.030"	$2^{3}/_{32}$"	4.00

*Minimum capacity loaded by circular rotor plates.
**Iso. rear end plate—ball and strap rear bearing.

THE ALLEN D. CARDWELL
MANUFACTURING CORP.
MAIN OFFICE & FACTORY
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relays which disconnect them if excessive current is applied through a wrong selection of the ratio arms. This overload setting is generally established at 40 ma.

Another feature which finds considerable use in the study of transformers is means for applying dc to any other winding on the transformer besides the one being checked for inductance, if desired. Means is afforded for the determination of the true voltage ratio of a transformer since the turns-ratio does not indicate the actual voltage ratio if appreciable leakage reactance is present.

The dc flowing through the inductance under test is indicated by a meter with seven ranges, covering from one milliampere full scale to one ampere full scale, permitting small currents to be as readily observed as large currents. The dc is controlled by a load-current switch and adjusted by the means of a second Variac.

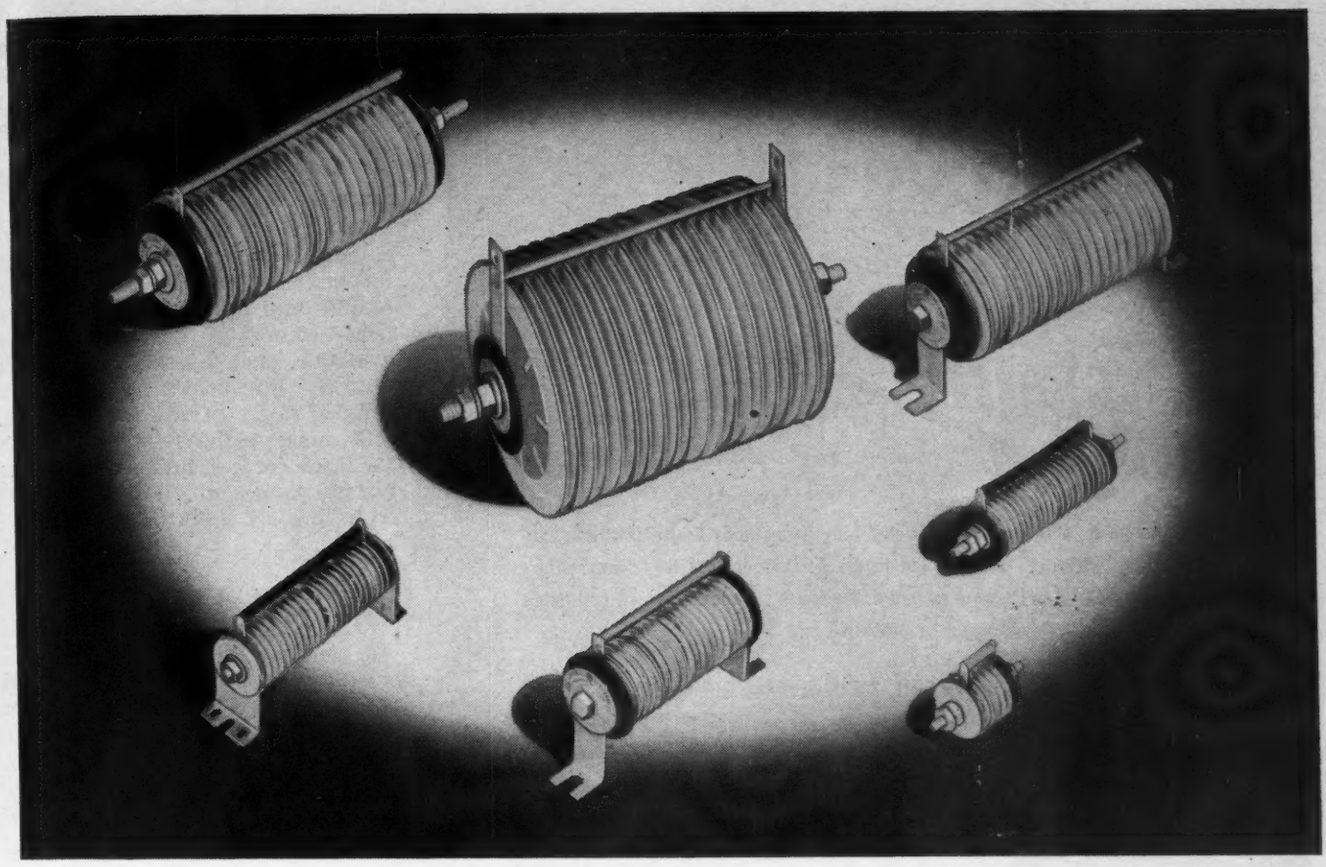
The input transformer to the detector amplifier is electrostatically shielded and in addition contains a stray field balancing arrangement to insure that the only voltage effective in the indicator is that which is due to bridge unbalance. The input to the detector is also provided with a phase-shift (bridged T) network so that a balance can be obtained for the fundamental frequency only.

Unbalance detector

The equipment contains the best unbalance detector indicator found in practice, a cathode ray oscillograph. This gives a direct indication as to whether the balance is being obtained against the fundamental frequency or against some harmonic which may have been introduced by the iron. The oscillograph amplifier has a variable attenuation of 100,000:1 to meet the needs of an indicator sensitive to all conditions from an applied signal of 300 v down to one of 10 millivolts.

A range of sweep frequencies is available to cover the possibility that tests may be needed at frequencies greater than 60 cycles using an externally connected oscillator.

With a judicious selection of the proper ratio arms, an accuracy to better than 1% can be obtained. This is possible by using adequate shielding between various parts of the bridge, and the use of separate power sources for all circuit ele-



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Electrically and mechanically they are built and exclusively processed to give dependable operation in either series, parallel or series-parallel connections. Too, they are constructed to withstand wide variances in ambient temperatures, humidities and atmospheric pressures.

Their small size, light weight and quiet operation plus their ability to resist shock and vibration make them ideal for use in radio and electronic fields, solenoids, relays, motors, instruments and numerous other applications.

For complete details, send for a copy of our catalog entitled, "G-E Selenium Rectifier Stacks." Address your requests to Section A5612-124, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

GENERAL ELECTRIC

Thousands of Marion Glass-to-Metal Truly Hermetically Sealed Electrical Indicating Instruments are now out in the field. Where are they going? Who's using them? And for what purposes? The scores are coming in . . . and here's one we thought you might be interested in.

Illustrated is the Reiner Model 333 Volt-Ammeter, developed by the Reiner Electronics Co. of New York. It's a new, versatile piece of equipment for laboratories, schools, repair shops, amateur radio operators, experimenters, etc. One unit unit can serve 20, or more, different instruments. Used exclusively in the DC Model 333 and the combination AC-DC Model 334 are Marion Glass-to-Metal Hermetically Sealed Instruments.

Reiner Model 333

More and more manufacturers are switching to Marion "hermetics". It makes sense to specify these instruments—whether you're a manufacturer, consumer or dealer. All Marion "hermetics" incorporate the new "Bulldozer" moving system, and are built in conformity with JAN standards . . . they're dust-proof and moisture-proof . . . they're economical and they last longer . . . they're available with interchangeable round or square colored flanges at no extra cost . . . and they're 100% guaranteed. Write for 12-page booklet.

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ments. For production testing, after a standard inductor is balanced in, the instrument also can be used as a limit bridge because the dial will then indicate plus or minus deviations from the standard.

The bridge described above represents one commercially available instrument which is arranged to handle any ordinary test problem. Less elaborate instruments are available, such as the inclusion of only the Hay bridge is used and a smaller range of the test voltages, and more elaborate setups with facilities for extending any of the normal ranges which may be needed in unusual tests.

LOOP FM ANTENNAS

(*Continued from page 76*)

bution. Loop diameters of several wavelengths are feasible, and for certain applications desirable.

"Electric-magnetic" dipole

This type of antenna may have wide application in the broadcasting field in the near future. With a diversified opinion on the relative merits of vertical versus horizontal polarization it seems feasible that an antenna that is circularly polarized (has both horizontal and vertical components) may prove the most satisfactory type of transmission. It is not difficult to prove experimentally that at any point around such an antenna one can

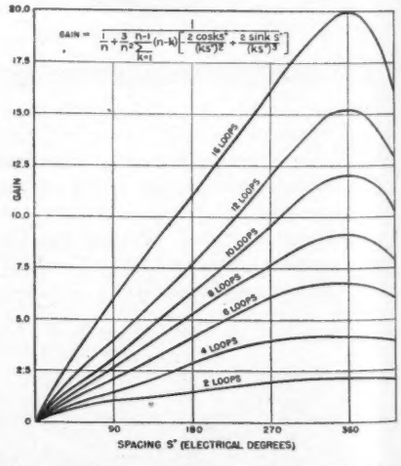

Fig. 9—Gain of linear array of loops when they are vertically stacked

achieve a field strength independent of the orientation of the receiving dipole, providing that the receiving probe dipole is kept perpendicular to the direction of propagation.

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FIRST TRIODE

EVER DEVELOPED THAT GIVES YOU

600 watts at 600 MC!

Now being used successfully in the powerful CBS color television transmitter operating at 490 MC carrier frequency with 10 MC bandwidth at 1 KW peak power output.

Federal's 6C22 is the *only* tube of this type ever to operate at this power output at such high frequency. It's *the* triode to use... as oscillator, amplifier, or frequency multiplier.

Four years of Federal engineering effort were spent in its development for radar equipment. Now it's ready for commercial broadcast use . . . with features making it especially suitable in the UHF spectrum.

For example, Federal's 6C22 has ring-seal electrode construction which reduces lead inductance . . . and extremely close interelectrode spacings to lower transit time losses.

And with 37 years of tube-building experience behind all Federal tubes, you'll find "extras" of rugged mechanical design in the 6C22, in addition to trustworthy electrical performance. It has no internal spacers to break down. Built with solid copper anode block, and water cooled, it works at the high power levels with complete safety. Write for complete information.

ACTUAL SIZE

TENTATIVE MAXIMUM RATINGS AND TYPICAL OPERATION

Key-down conditions without amplitude modulation. Maximum ratings for frequency of 600 MC.

DC Plate Voltage . . . . 2500 Volts
DC Plate Current . . 0.75 Amperes
DC Grid Current . . . .075 Amperes
Plate Input . . . . . 1875 Watts
Plate Dissipation . . . . 1000 Watts

Typical operation— Self-excited oscillator

FREQUENCY MC	PLATE VOLTAGE VOLTS	PLATE CURRENT AMPERES	POWER OUTPUT WATTS
300	2500	0.70	900
400	2500	0.65	800
500	2200	0.70	680
600	2000	0.65	500

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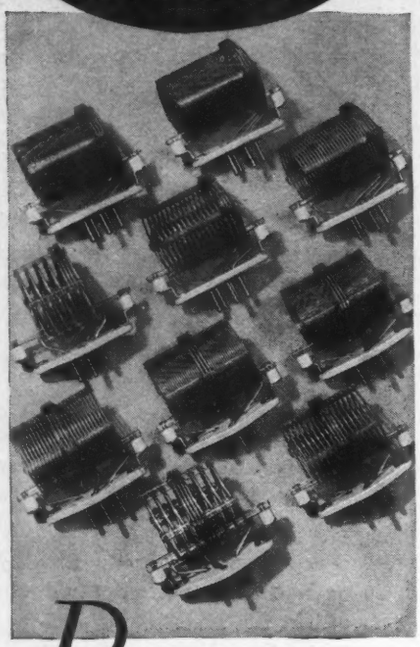

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No other type of coil can equal B & W AIR Inductors for all-around efficiency. AIR WOUND Inductors are lighter, easier to tap, wound to uniform pitch, have exceptionally low dielectric loss (no winding form in coil field) and are extremely durable. There is little about them to break if dropped. Even if bent completely out of shape, they can easily be repaired. B & W types include standard, fixed and swinging link assemblies in sizes and ratings for almost any application. Write for catalog.

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In addition this type of antenna probably will prove to be very valuable in ultra-high-frequency communication networks where considerable fading exists due to changes in the medium of propagation. In cases of severe fading the probabilities are that both horizontal and vertical components of the electric field will not vary at the same rate since they are affected differently by the reflecting medium between transmitter and receiver.

In other words a wave with unidirectional polarization where just two vectors (reflected and direct wave) must add up to zero, is much more likely to exhibit fading than a duo-directional polarized wave where four vectors must add up to zero. Considerable improvement, therefore, should be experienced in reducing the overall fading by the use of such a radiator, or a combination of such radiators in an array.

The advantages of this type of transmission were recognized by Dr. Kolster of International Telephone and Telegraph Corporation as far back as 1929. Three systems radiating circularly polarized waves were designed and examined. This present type of "electric-magnetic" dipole (Fig. 10 and 2) consists essentially of the loop radiator previously described to which a vertical dipole has been added at the junction of the transmission line and the center of the loop. In effect it is a combination of an "electric" and a "magnetic" dipole.

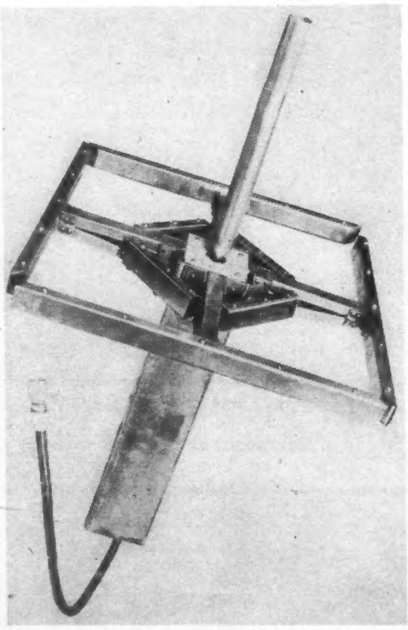

Fig. 10—"Electric-magnetic" type of coaxially fed loop with vertical radiator for 350 mc

The only difference between a wave radiated from the horizontal

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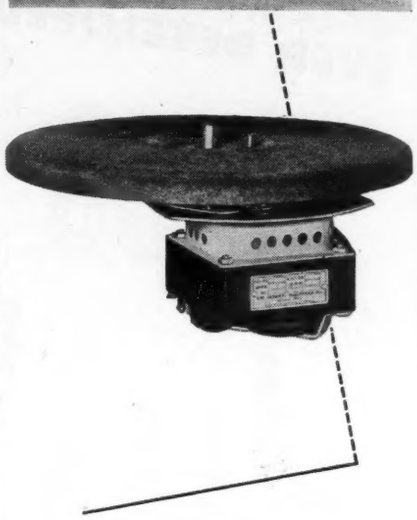
WITH
Smooth Power



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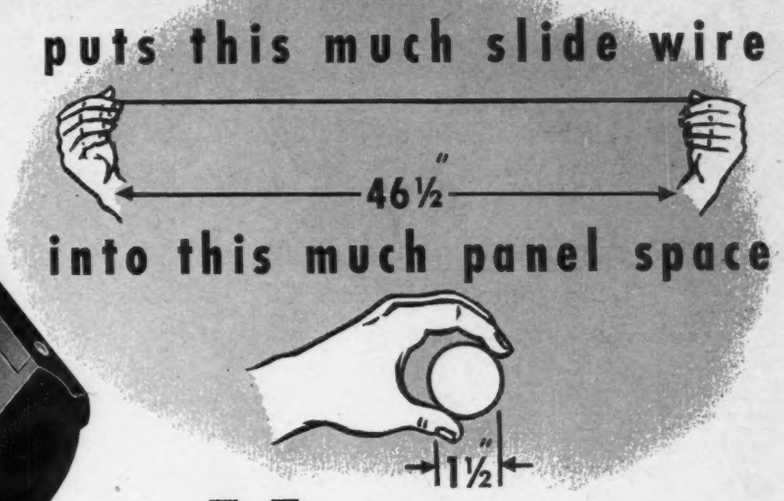
Cutaway View of Helipot



It's the BECKMAN Helipot

(Trade mark for the HELical POTentiometer)

No matter what type quality electronic instrument you may be manufacturing or preparing to manufacture, be sure to investigate the *multiple* advantages you can build into your product by using Beckman Helipots for resistance control. Warperfected on such ultra-precision electronic equipment as radar, flight control instruments, depth sounding devices, etc., the Beckman Helipot makes possible entirely new standards of accuracy, convenience and compactness in resistance controls.

Unlike conventional potentiometers which consist of a single turn of slide wire, the Helipot has *many* turns of slide wire *helically* coiled into a compact case *that occupies no more panel space than a conventional single-turn potentiometer.* The slider contact is rotated by a knob in the usual manner and a simple device guides the slider contact as the knob is rotated so that the entire helical length of resistance winding can be contacted.

Its advantages are many. Heretofore circuits requiring precise control coupled with wide range have generally required at least two potentiometer units—one for coarse adjustment and the other for fine adjustment. This means *two* knobs to operate... *two* controls to waste panel space... *two* units to complicate installation and wiring. In the Beckman Helipot *both* wide range and fine adjustment are combined in the *one* unit. There is only *one* knob to operate... *one* unit to take up panel space... *one* control to install and wire. You not only save valuable panel space and assembly time, but you greatly increase the convenience, utility, simplicity and operating efficiency of your electronic instruments. Note these outstanding Helipot features...

High Linearity—As a result of fulfilling wartime requirements for ultra-precision circuit controls, Helipots are mass-produced with linearity tolerances of *one tenth of one per cent*—and even less!

Precise Settings—Because of the many times longer slide wire, settings can be made with an accuracy impossible with single turn units.

Wide Range—By coiling a long potentiometer slide wire into a helix, the Helipot provides *many times* the range possible with a single turn unit of comparable diameter and panel space.

Low Torque—Of special interest for power-driven applications—the Helipot has unusually low torque characteristics. The 1½" Helipot—for example—has a torque of *only one inch/ounce.*

Wide Range of Sizes—Current Helipot production is in two basic sizes, each available in a wide range of ratings. The Type A Helipot is 1½" in diameter and is available in ten or fewer turns of slide wire. The ten turns provide a slide wire 46½" long.

The Type B Helipot is 3" in diameter with 15 turns of slide wire as standard, but is available with either fewer or more turns on order. The 15 turns give a slide wire 140½" long.

Resistance windings can be supplied in virtually any commercially available type of resistance wire for both Type A and Type B so that total resistance values for Type A range from 100 to 30,000 ohms... for Type B from 650 to 100,000 ohms.

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loop whose diameter is of the order of a half a wavelength or less and that of the vertical dipole is in the polarization. Thus, if the current fed to the antenna is distributed equally to both radiators with a 90° phase difference a circularly polarized wave (one in which both the vertical and horizontal components are of the same magnitude and 90° out of phase) will result. However, it is possible to control both the phase and amplitude of these currents so that any plane polarization that is desired can be produced—i.e. horizontal, vertical, circular, or in the most general case, elliptical.

No extensive field tests have as yet been run to determine all of the electrical characteristics of this antenna. Tests run in 1929 using this type of transmission indicated a definite reduction in fading. On the present type of antenna a mismatch versus frequency measurement was run on an experimental 1200 mc. "electric-magnetic" dipole and indicated that it can be designed to have a comparatively wide bandwidth. (Fig. 11).

A possible application of this type of antenna for home receivers may arise if the broadcasting studios do not agree on the type of polarization to be used. Thus, it is possible that in order for the listener to receive all the stations he would have to use an "electric-magnetic" dipole.

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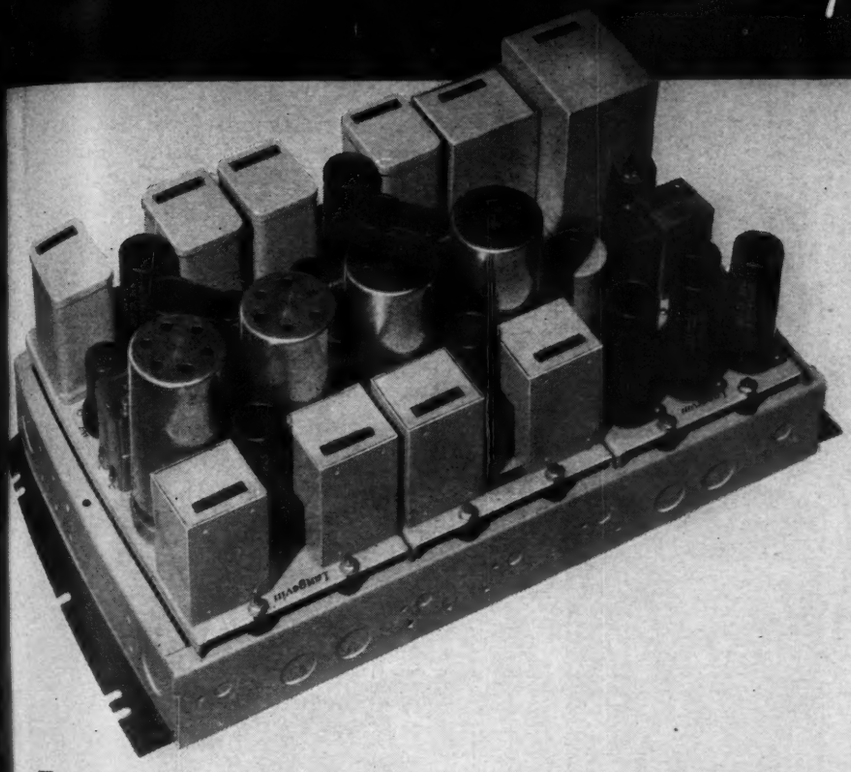
EXPORTS

(*Continued from page 81*)

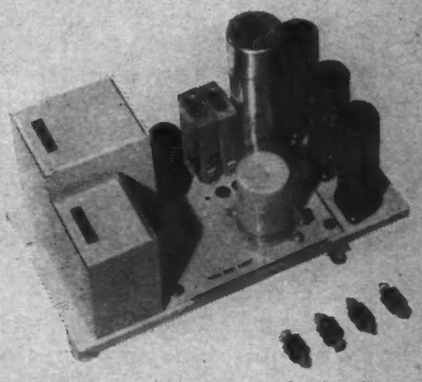
sideration. The current preference here may be for cabinets having no corners and composed entirely of curves of varying radii, but it happens that much of the foreign taste finds this style so ugly as to create real sales resistance, and would far prefer simpler rectangular models. While additional costs

STUDIO AMPLIFIERS

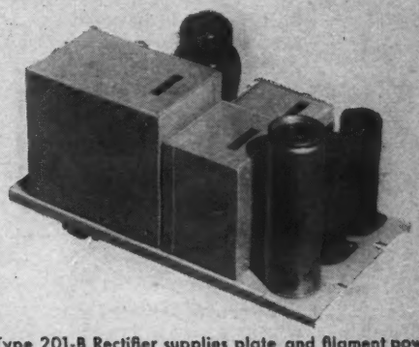
Engineered for High Quality Performance and Dependable Service



AT LEFT: Two Langevin Type 111-A Dual Pre-Amplifiers and one Langevin Type 102-A Amplifier on a Type 3-A Mounting Frame. This unit provides four pre-amplifiers and one line amplifier, or three pre-amplifiers, one booster amplifier and one line amplifier, all occupying 10½ in. of rack mounting space. An external power supply, the Langevin 201-B Rectifier, as shown below, is required. The Type 3-A Mounting Frame can be housed in a Type 201-A Cabinet, for wall mounting, if desired.



The Type 106-A Amplifier is a two-stage, fixed medium gain, low noise pre-amplifier, or booster amplifier, for use in high-quality speech input systems. The Type 106-A can be mounted on one-third of the space available on a Type 3-A Mounting Frame in combination with two Type 111-A Pre-Amplifiers, or in any similar combination.



The Type 201-B Rectifier supplies plate and filament power for the Langevin Types 102, 106, 111 and similar amplifiers from a 105-125 volt, 50-60 cycle AC source. The ripple voltage of the 201-B Rectifier is 0.04% at full power output 75MA and 0.02% at a drain of 30 milliamperes.

Langevin Audio Transmission Facilities are designed and built to have the extended frequency response, noise and distortion levels required in the F.C.C. Regulations for FM transmission.

In complying with these regulations too much emphasis cannot be placed on the quality of the transformers that are a part of the audio system. Noise, for instance, is largely associated with the input transformers—distortion, with the output transformers—and frequency response with both. Therefore, the transformers in Langevin equipment are manufactured by us—and are held to a specified tolerance—so that frequency response, noise and distortion levels of the entire system are well within requirements.

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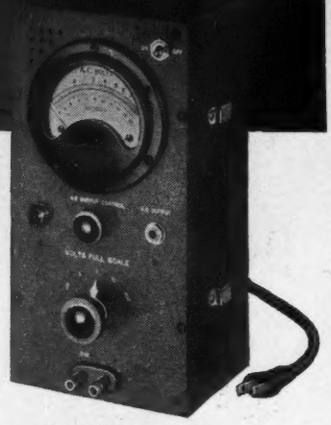

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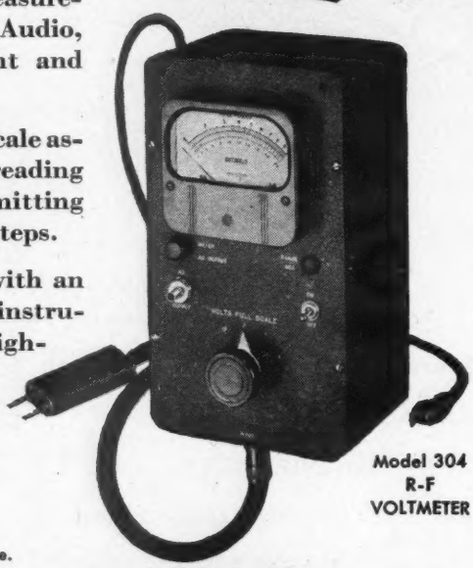
Each Voltmeter equipped with an output jack so that the instruments can be used as a high-gain stable amplifier.



Model 304
R-F
VOLTMETER

SPECIFICATIONS

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RANGE—.001 to 100 volts.
FREQUENCY—10 to 150,000 cycles.
ACCURACY—2% at any point on scale.
AC OPERATION—110-120 volts.

MODEL 304

RANGE—.001 to 100 volts.
FREQUENCY—30 c.p.s. to 5.5 megacycles.
ACCURACY—0.5 DB.
AC OPERATION—110-120 volts.

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may be incurred by such box changes due to lower volume, no insuperable difficulty is presented.

As stated before, many manufacturers are apt to look with jaundiced eyes at these export problems as being in the nature of additional headaches when their time is already fully occupied by the headaches of the domestic market and the OPA. If for no other reason however, the export market should be cultivated as a matter of insurance. In the debates on the 3.75 billion dollar loan to Great Britain, some of the British commentators objected on the grounds that the promises given would tend to tie their more stable manufacturing and distribution system to the "oscillating economy" of the United States.

That our economy has this characteristic is certainly not to be gainsaid, and most American manufacturers recognize it and want to guard against it. What better insurance can there be than to widen one's market by foreign distribution—particularly when the distribution is likely to be quite profitable. Why not surrender a portion—say 10% of production—of the otherwise attainable share in the highly competitive U. S. market for this excellent anchor to windward.

Credit problems

The distribution which is obtained in foreign countries should be picked with great care—possibly more carefully than that in the United States in view of the distance involved. All selling should be done to certain definite representatives in the countries involved, and requests from others in the same territory should be referred to the chosen representatives. A hit or miss policy of dealing with anyone who writes an inquiry provided they establish proper credit in the U. S. is undesirable and may result in the loss of good solid outlets.

In this connection, the matter of credit should be investigated carefully. There are plenty of high class reputable firms operating in the distribution field in the various countries with which we may wish to do business, and to ask some of them to set up New York funds before shipment may be as distasteful and ridiculous to them as it would be to some of our large distributors.

Most of the distributors are apt to handle a number of lines which

Known as the finest.. **HERMETIC SEALING**

ELIMINATES TERMINAL SOLDERING

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  - . . Terminal pull test.
  - . . Hot tin dip.
- Glass of terminals completely free of surface carbonization; high surface resistance.
- TERMINALS MAY BE ARRANGED WITH A MINIMUM SPACING IN ANY PATTERN OR COMBINATION OF VOLTAGE RATINGS!
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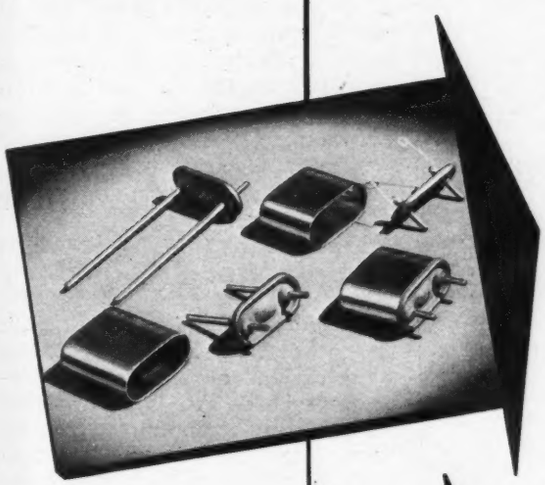
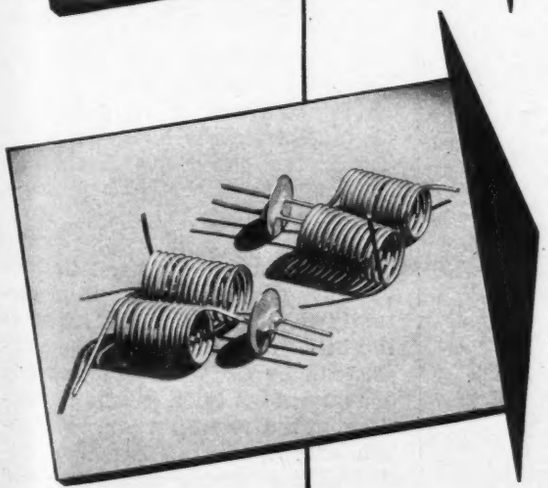
  - . . Salt spray corrosion
  - . . Hydrogen pressure tested for leaks
  - . . Polariscope inspected for glass strains
  - . . Hi-potential tested for voltage breakdown

Modern equipment and improved manufacturing facilities permit production of large or small quantities quickly and economically.





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might be considered separate in the United States, as for instance, automobiles, automobile parts, radios, home appliances, etc. They may also operate one or more retail stores. Jobbers as they are known here are not frequently met with.

If the statements made here and the program laid out seem to require an undue concentration of effort for the small manufacturer it should be remembered that there are several excellent export firms well acquainted with the foreign market who can take over the entire load of knowing the market and its requirements and who will buy the manufacturers' products for cash, taking even the financial exporting risk off his shoulders. These concerns which have been in the business and have established a reputation generally operate on a definite percentage basis.

In the present unsettled state of the world one of the difficulties with exporting is the matter of obtaining import licenses for the countries of destination. Some of them such as South Africa, a large gold producer, and some colonies which have enjoyed an excellent trade in the export of basic raw materials during the war and hence are loaded with cash interpose no difficulties for the American exporter. Others, particularly in the Sterling bloc have highly restricted import licensing systems, even going so far occasionally as to "neglect" to act upon applications for licenses even where they are officially supposed to be on a fairly free basis. This is done with the idea of preventing Americans who have the only exportable goods at the present time from gaining a foothold in markets heretofore pretty much monopolized by other exporting countries.

Such practices may make the American exporter very unhappy but since there is nothing to do about it he must live with them. The fact of the matter is that the Sterling area is so very short of foreign exchange that there is not much else that the countries involved can do but restrict imports by every possible means. And certainly no one should be lulled to the belief that passage of the British loan by Congress will result in a removal of such trade restrictions. That certainly can not happen except over an extended period of time during which England will attempt to rebuild its exchange position. The amount of the loan is far too small to permit unrestricted importing.

GUTHMAN

precision

COILS

Precision, a word basic to radio and electronics, has been made commonplace by over-use and often false by misuse . . . where it guides the purchase and production of materials, and sets the standards for engineering research as well as for the manufacture of the finished and inspected product, PRECISION becomes again a word of importance. It is so conceived and used by Guthman.

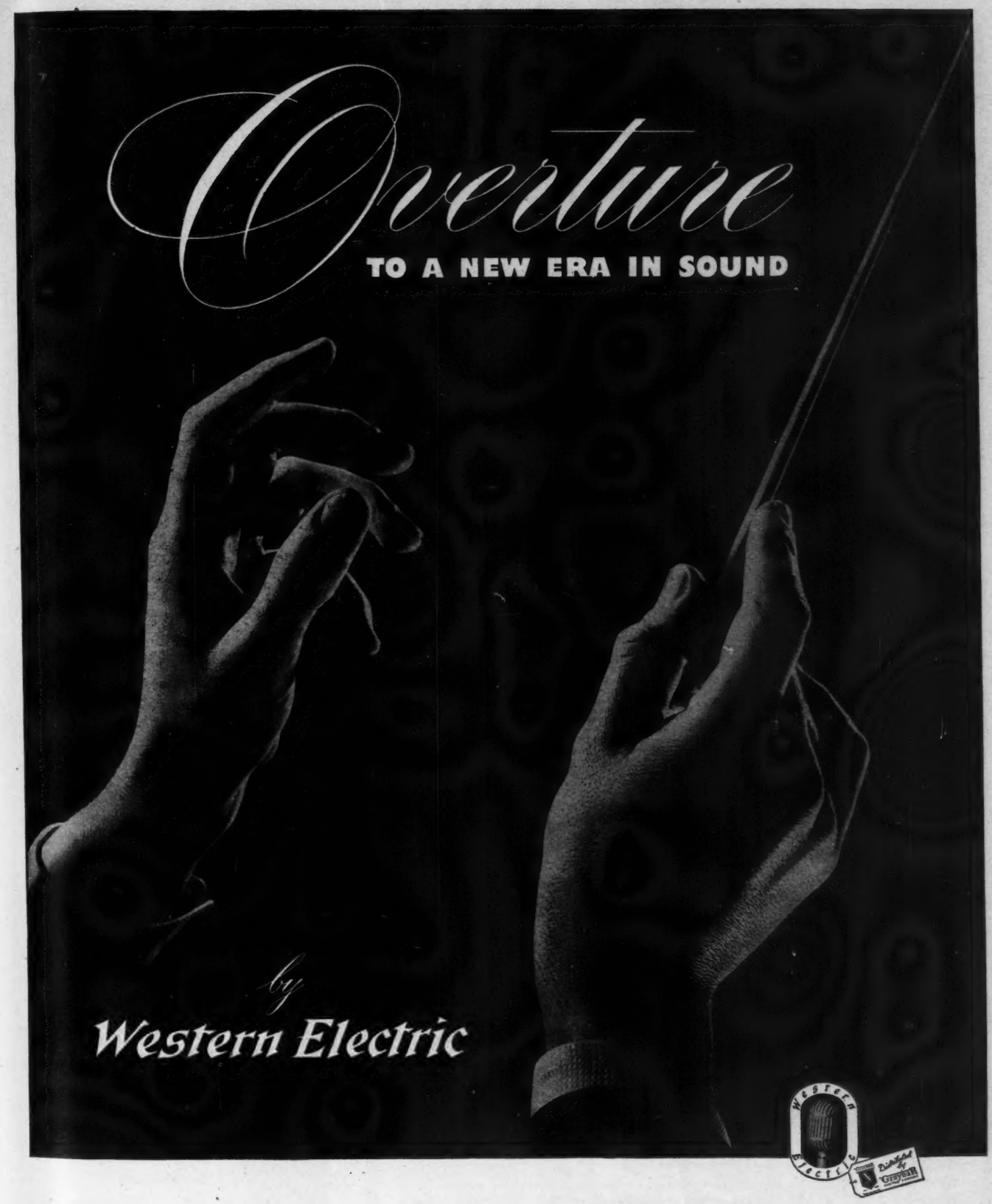
EDWIN I. GUTHMAN & CO., INC., 15 S. THROOP, CHICAGO 7, ILL.

★I. F. Transformers
★R. F. Coils & Chokes
★Trimmer Condensers
★Zinc Shield Cans
★R. F. Assemblies
★Textile Insulated Litz & Magnet Wire

Visit Our Booth No. 115
1946 Radio and Electronic Parts Show

Guthman

CHICAGO



HAVE you ever heard a sound system with such natural tone, such emotional quality, such "presence" that you didn't know instantly that a sound system was in action? It's pretty safe to say you never have. But now you can!

Revolutionary advances born of wartime research have resulted in a new Western Electric loudspeaker that reproduces speech and music with unsurpassed fidelity.

You'll find it hard to believe you are listening to *reproduced* sound rather than the original. That is why this new Western Electric loudspeaker is destined to open a new era in all fields of sound reproduction.

Laboratory Standard

INSTRUMENTS

built for Accuracy and Endurance

STANDARD SIGNAL GENERATOR Model 80

This instrument is well suited for development and production testing in the recently allocated FM and Television bands. The absence of stray fields or leakage permits accurate measurement of the most sensitive receivers.

SPECIFICATIONS:

CARRIER FREQUENCY RANGE: 2 to 400 megacycles.

OUTPUT: 0.1 to 100,000 microvolts. 50 ohms output impedance

MODULATION: AM 0 to 30% at 400 or 1000 cycles internal. Jack for external audio modulation.

Video modulation jack for connection of external pulse generator.

POWER SUPPLY: 117 volts, 50-60 cycles.

DIMENSIONS: Width 19", Height 10¾", Depth 9½".

WEIGHT: Approximately 35 lbs.

PRICE: $465.00 f.o.b. Boonton

Suitable connection cables and matching pads can be supplied on order.

Model 62

VACUUM TUBE VOLTMETER

SPECIFICATIONS:

RANGE: Push button selection of five ranges—1, 3, 10, 30 and 100 volts a.c. or d.c.

ACCURACY: 2% of full scale. Usable from 50 cycles to 150 megacycles.

INDICATION: Linear for d.c. and calibrated to indicate r.m.s. values of a sine-wave or 71% of the peak value of a complex wave on a.c.

POWER SUPPLY: 115 volts, 40-60 cycles—no batteries.

DIMENSIONS: 4¾" wide, 6" high, and 8½" deep.

WEIGHT: Approximately six pounds.

PRICE: $135.00 f.o.b. Boonton, N. J. *Immediate Delivery*

MANUFACTURERS OF

Standard Signal Generators
Pulse Generators
FM Signal Generators
Square Wave Generators
Vacuum Tube Voltmeters
UHF Radio Noise & Field Strength Meters
Capacity Bridges
Megohm Meters
Phase Sequence Indicators
Television and FM Test Equipment

MEASUREMENTS CORPORATION

BOONTON NEW JERSEY

MARKETING, Twin Problem with PRODUCTION

(*Continued from page* 83)

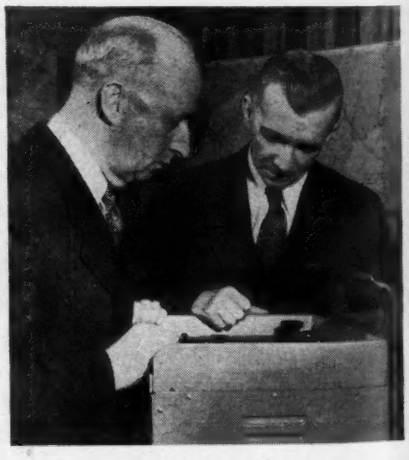
company demonstrated and explained new things to engineers of other companies.

Simple as it is to set down general principles that may be desirable for all, there is no denying the difficulty of applying them to the varied conditions confronting individual companies. There is no ready-made plan; no over-all method. It may be helpful, therefore, to set forth a few of the critical differences.

Take the case of a manufacturer who begins to plan the marketing of a product that he has never sold before. He sets out on an uncharted course when he starts to visualize his needs. First, he will do well to make certain that he has the right perspective on the problems he is certain to encounter. He can begin to get his bearings as soon as he can answer some pertinent marketing questions. He will see the critical differences between which he must make a choice.

These accompanying questions merely highspot the job. At every step in building a plan, there are many other options; good, bad and indifferent. The manufacturer must determine for himself how they differ, how they fit his aims, how they will probably work out in the beginning and, more important, how they will work out in the end.

COMMERCIAL LORAN



Preston R. Bassett, president of the Sperry Gyroscope Co. which built the equipment and made the installation, at demonstration of Loran receiver that helped Captain Harry G. Nordenson (left), skipper of the ship, navigate the M/S Gripsholm between the Mediterranean and New York

DUMONT PAPER CAPACITORS

HEATPROOF

Dumont condenser ends are sealed with bakelite resinoid to withstand 350° F. continuous operation.

SMALL SPACE

1/4" OD x 3/4" LONG AT 600 VOLTS

Compact . . . solves space problems

MOISTUREPROOF

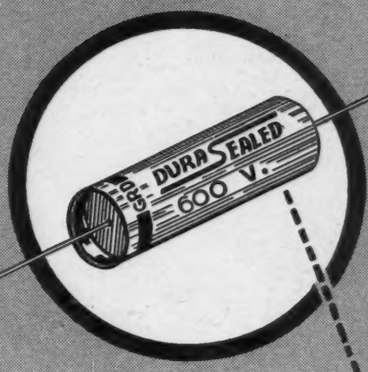
UP TO 100% HUMIDITY

Sealed under vacuum. No air voids to cause entry of moisture

LONG LIFE

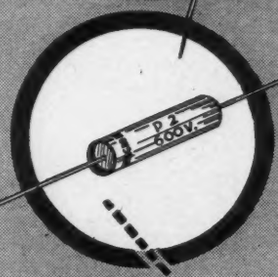
NO HIGH TEMPERATURE OR HIGH PRESSURE

Used in the manufacture of these condensers . . . thus assuring long life and High Surge Rating to these units.



DUMONT TYPE P6

DUMONT TYPE P2



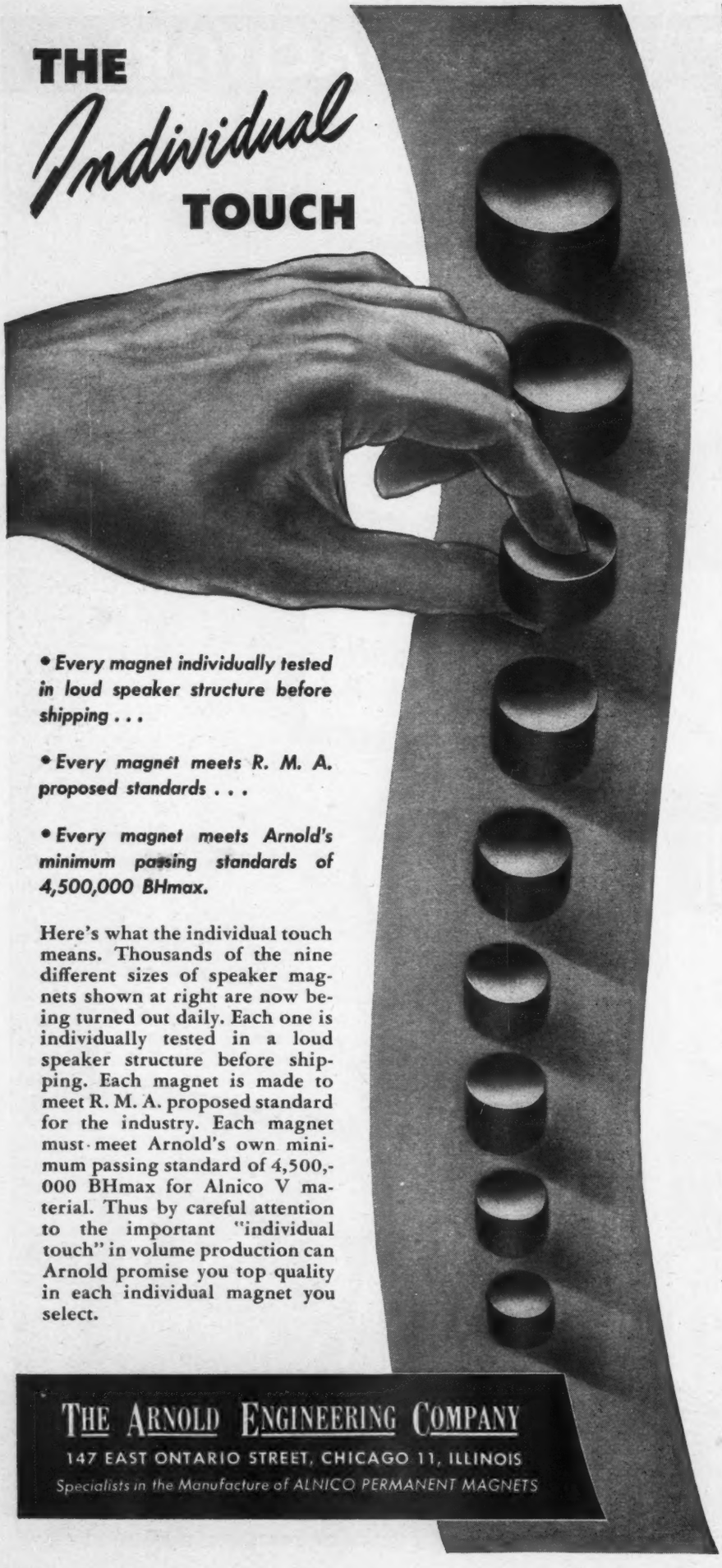
Sealed with DUMONT BAKELITE RESINOID

DUMONT ELECTRIC CORP.

MFR'S OF CAPACITORS FOR EVERY REQUIREMENT

34 HUBERT STREET NEW YORK, N. Y.

THE *Individual* TOUCH



• *Every magnet individually tested in loud speaker structure before shipping . . .*

• *Every magnet meets R. M. A. proposed standards . . .*

• *Every magnet meets Arnold's minimum passing standards of 4,500,000 BHmax.*

Here's what the individual touch means. Thousands of the nine different sizes of speaker magnets shown at right are now being turned out daily. Each one is individually tested in a loud speaker structure before shipping. Each magnet is made to meet R. M. A. proposed standard for the industry. Each magnet must meet Arnold's own minimum passing standard of 4,500,000 BHmax for Alnico V material. Thus by careful attention to the important "individual touch" in volume production can Arnold promise you top quality in each individual magnet you select.

THE ARNOLD ENGINEERING COMPANY

147 EAST ONTARIO STREET, CHICAGO 11, ILLINOIS

Specialists in the Manufacture of ALNICO PERMANENT MAGNETS

NEWS OF INDUSTRY

(*Continued from page 98*)

886 different brands of radios on the market.

In 1930 the radio industry produced 3,628,691 units at an average price of $42.11. In 1939, the industry manufactured 10,762,638 units at an average price of $13.69.

Between 1932 and 1940 the price of a typical table model radio dropped from $25 to $9.95.

Indicative of the chaotic conditions existing in the radio industry are the following comments from the committee report:

As of January 27, 1946, only 38 of 141 licensed manufacturers had reported any production, shipping or billing of home radio receivers since VJ Day.

In the week ended January 11, 1946, only two console radio-phonograph sets were shipped and billed by the entire radio industry.

John Ashton, Consultant

John Ashton, pioneer radio research engineer, formerly associated with many well-known radio developments, has opened a radio laboratory on Riversville Road, RFD No. 4, Greenwich, Conn., and is entering general radio engineering practice. He was an early associate of DeForest and Armstrong, and has served with Telefunken, Radiomarine Corp., NBC, United Broadcasting, U. S. Steel, U. S. Cartridge, MIT Radiation Labs., Fairchild Camera, Majestic, Stewart-Warner, Scott, and Belmont Radio organizations.

Block-Wormser Moves

Block-Wormser Co. factory representative, has occupied new headquarters at 60 East 42nd Street, New York. The company specializes in electronic and mechanical assemblies, designs and engineers' wood, metal and plastic products.

Killian and Tourney Were Raytheon Authors

Through an inadvertant oversight the Editors of Electronic Industries neglected properly to credit the authors of the article appearing in the April FM issue of the publication under the heading: "Two-Studio Console". The equipment is manufactured by Raytheon Mfg. Co., Chicago and the description was written by Leo G. Killian and Paul Tourney.

partners in creating

"Impossible" is a word that is not recognized by engineers. To dam a mighty river, tunnel under it or suspend a bridge across it—things such as these that once seemed pure imagination were made possible by instruments devised to refine and extend human faculties, to translate the precision of engineering thought into action.

Keuffel & Esser Co. is proud to have played so large a part in making such instruments widely available. In this way K & E equipment and materials have been partners of the engineer and draftsman for 78 years in shaping the modern world. So universally is this equipment used, it is self-evident that K & E have played a part in the completion of nearly every engineering project of any magnitude. Could you wish any surer guidance than this in the selection of your own "partners in creating"?

Not only for construction and building, but for setting up precision machine tools and long production lines, in the fabrication of large ships and aircraft, experienced engineers know that they can rely utterly on K & E transits and levels. Coated lenses for increased light transmission, precision-ground adjusting screws, chromium-coated inner center and draw tubes, completely enclosed leveling screws, improved achromatic telescopes—all these typify the advanced design of these instruments.

. . . the world's busiest tunnels
. . . largest telephone system
K+E
Drafting, Reproduction, Surveying Equipment and Materials. Slide Rules, Measuring Tapes.
KEUFFEL & ESSER CO.
EST. 1867
NEW YORK • HOBOKEN, N. J.
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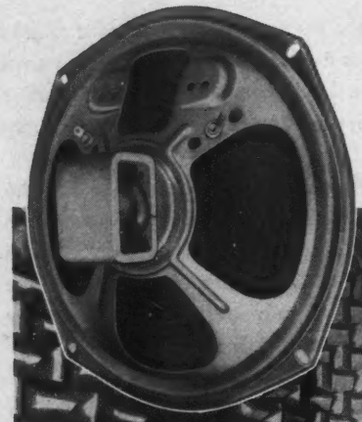
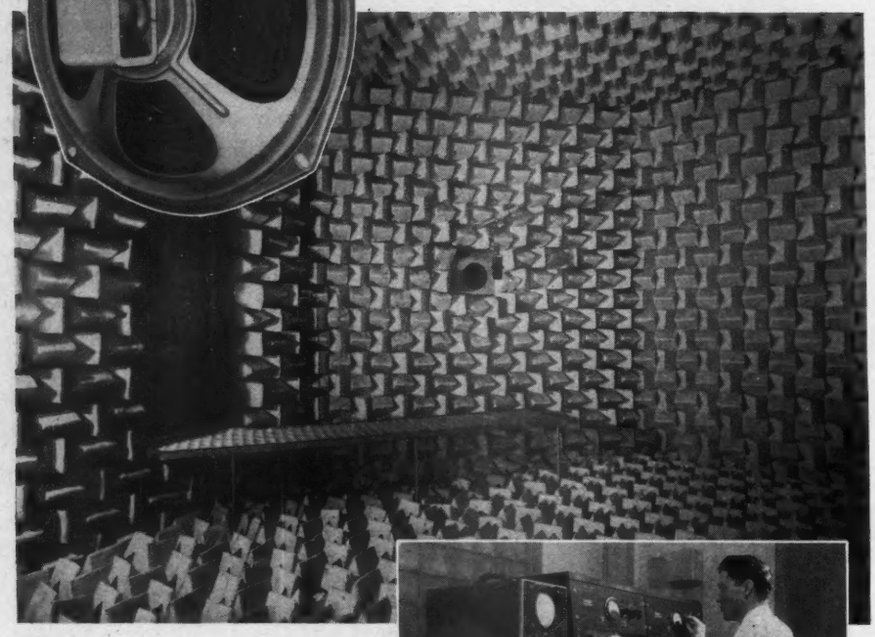
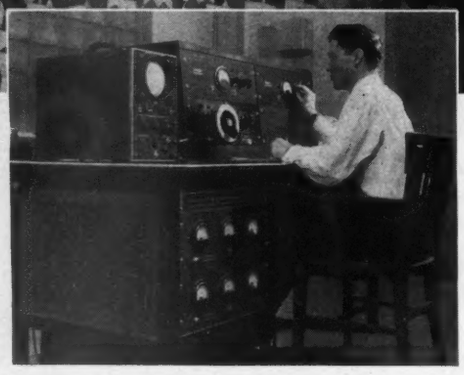


The Difference Between "We Think So" and "We KNOW So"



Permoflux Speakers



...are Engineered for Application in this Stalactite Acoustical Chamber

In this completely soundproof room, asymmetrical walls and carefully designed mass-interval baffles effectively reduce troublesome resonant harmonics and reflected sound to an insignificant value. Response curves are plotted which represent true performances so that Permoflux engineers can say "We Know So." Its use at Permoflux is characteristic of the many factors which make it possible to substantiate the fact that Permoflux Speakers provide the finest possible sound reproduction.

SEE US AT THE CHICAGO TRADE SHOW—BOOTH 32

TRADE MARK

PERM-O-FLUX

PERMOFLUX CORPORATION

4900 WEST GRAND AVE., CHICAGO 39, ILL.

PIONEER MANUFACTURERS OF PERMANENT MAGNET DYNAMIC TRANSDUCERS

NEW PATENTS

(*Continued from page* 102)

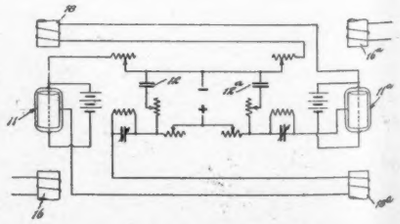
tion of the optical path length as a certain path length in a crystal is equivalent to a different path length in air. It is also proposed to use birefringent crystals as the element which controls the optical path length; with Rochelle salt as the birefrigent material, 100 volts will cause a frequency shift of 85 radians. Another way of modulating the light ray is by means of the Kerr effect.

Regardless of the system used, a cosine wave, the argument of which is proportional to the signal amplitude, and a sine wave, the argument of which is proportional to the signal amplitudes, may be generated. Then each of these waves is combined with the carrier wave to give the two cosine x sine products, addition of which results in frequency-modulation of the carrier.

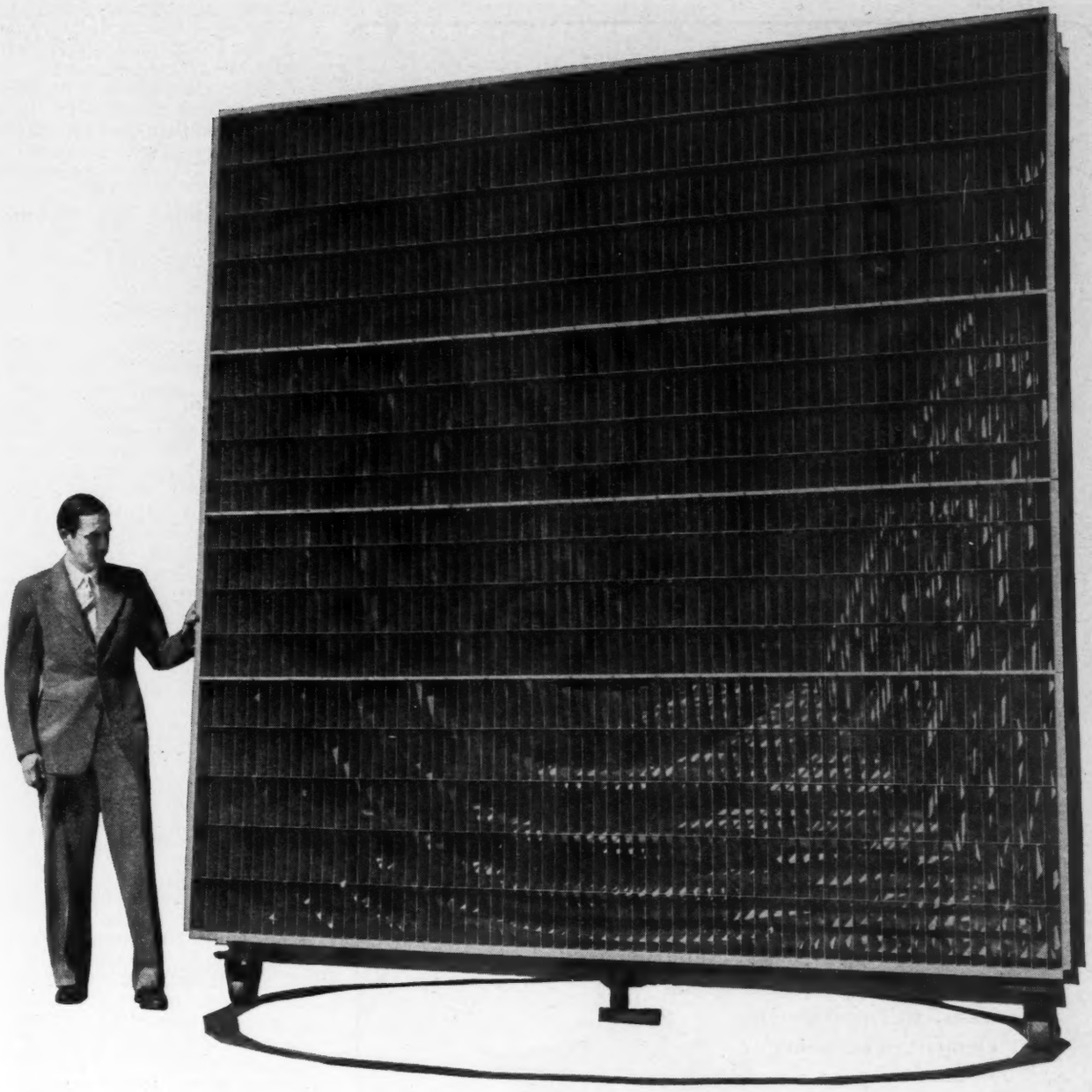
F. J. D'Agostino and S. A. Valdes, Hartford National Bank and Trust Company, (F) April 19, 1943, (I) September 18, 1945, No. 2,385,086.

Magnetron Multivibrator

The two magnetrons 11 and 11a conduct current alternately and operate similar to the two tubes of a multivibrator. Assuming tube 11 conducts, electro-magnet 18a will be energized and the combined fields of the separate magnet 16a and the magnet 18a will oppose conduction of tube 11a. However, capacitor 12a is being charged in the meantime and at the instant it has built up a sufficient voltage across tube 11a, this tube and the associated circuit will carry current. Current in this circuit energizes electro-magnet 18 the field of which adds to the field of the separate magnet 16 quenching conduction through tube 11. Current through the winding of electro-magnet 18a will cease and the tube 11a therefore continues to conduct though the voltage across it is reduced as the capacitor 12a discharges.



When the capacitor 12 has built up sufficient voltage across tube 11 to make it conduct current, the identical operation will result with the roles of tubes 11 and 11a and their associated circuits reversed. Continuous multivibrator action



A "SEARCHLIGHT" TO FOCUS RADIO WAVES

In the new microwave radio relay system between New York and Boston, which Bell Laboratories are developing for the Bell System, giant lenses will shape and aim the wave energy as a searchlight aims a light beam.

This unique lens—an array of metal plates—receives divergent waves through a waveguide in the rear. As they pass between the metal plates their direction of motion is bent inward so that the energy travels out as a nearly parallel beam. At the next relay point a similar combination of lens and waveguide, working in reverse, funnels the energy back into a repeater for amplification and retransmission.

A product of fundamental research on waveguides, metallic lenses were first developed by the Laboratories during the war to produce precise radio beams.

This "searchlight" is a milestone in many months of inquiry through the realms of physics, mathematics and electronics. But how to focus waves is only one of many problems that Bell Telephone Laboratories are working on to speed microwave transmission. The goal of this and all Bell Laboratories research is the same—to keep on making American telephone service better and better.

BELL TELEPHONE LABORATORIES

EXPLORING AND INVENTING, DEVISING AND PERFECTING FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE

An Announcement To Those Who Require *The Best*

THIS advertisement is addressed to the manufacturers of electronic equipment whose product demands the best in component parts—who will want the best in transformers, *if* "the best" is offered at a price that will fit the cost specifications of their finished product.

By adapting to peace-time use the major features of the Hermetically-Sealed transformer construction that won war-time leadership, Chicago Transformer is prepared to provide the best in transformers to those who require them. Fully developed basic mounting parts, when utilized on a mass production basis, will provide the element of economy in manufacture.

CHICAGO TRANSFORMER

DIVISION OF ESSEX WIRE CORPORATION

3501 WEST ADDISON STREET

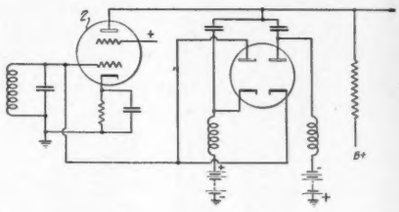
CHICAGO, 18

will thus be maintained once one of the tubes conducts current. By suitable adjustment of the variable circuit elements, recurrence frequency and duration of the pulses may be controlled. The two halves of the circuit may be made unsymmetrical to give unsymmetrical pulses.

M. Chodorow, Maguire Industries, Inc., (F) August 28, 1943, (I) Dec. 25, 1945, Nos. 2,391,545 and 2,391,546.

Limiter Circuit

The limiter circuit is adapted for rapid response to excessive amplitudes to suppress short noise impulses in frequency-modulated waves. Two diodes are connected to supply negative feedback voltages upon large outputs of the amplifier tube 2, the two diodes taking care of negative and positive peaks, respectively. These amplitude-controlled feedback voltages will limit the output of the amplifier to a desired value by reducing any grid voltage exceeding a predetermined value.



The feedback voltage may be applied to the screen grid of a pentode, while the incoming signal is applied to the control grid. In another version, inductively coupled feedback is used. The two diodes may be replaced by suitably connected triodes, the grids of which are controlled by the plate voltage of amplifier 2.

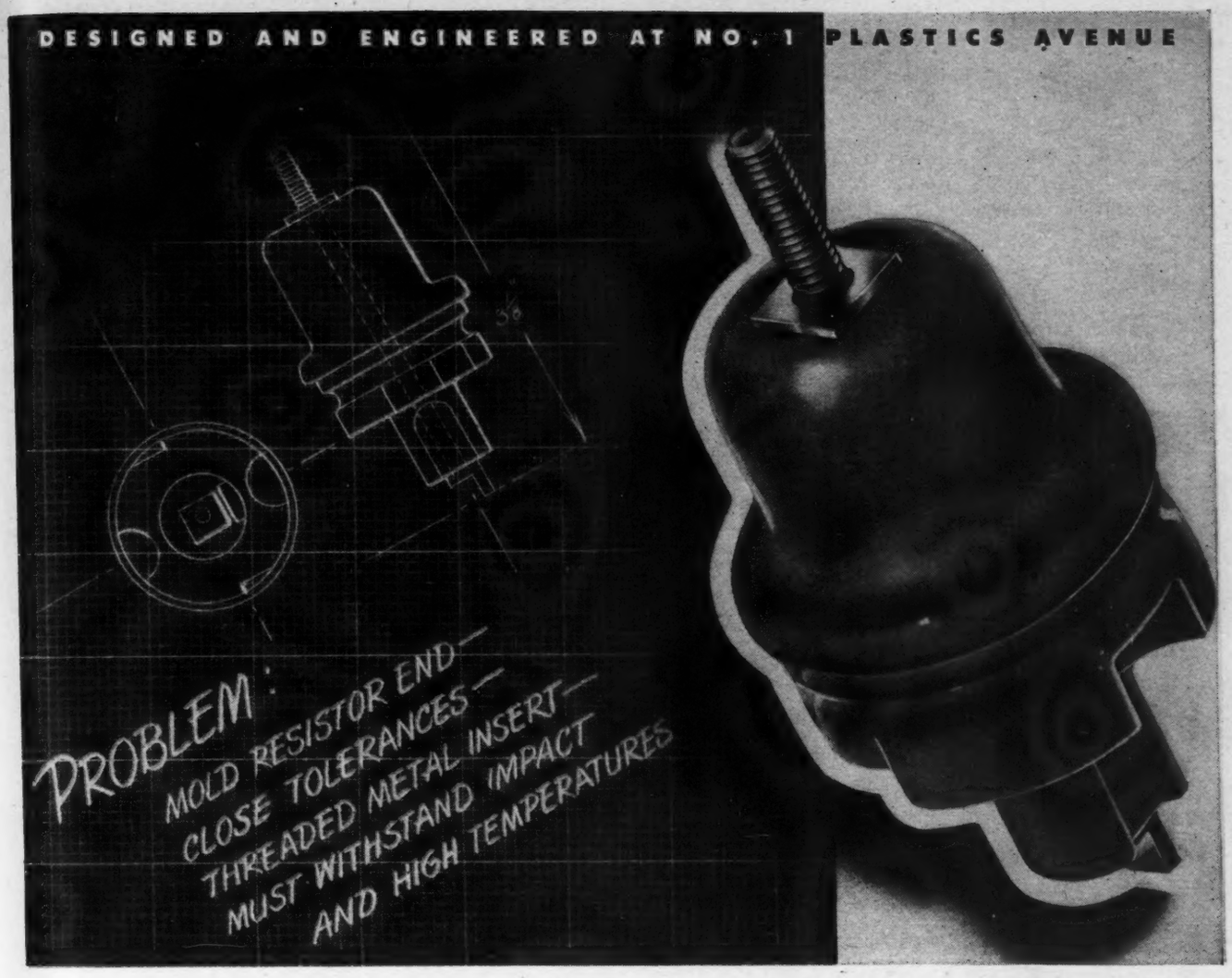
C. E. Atkins, Tung-Sol Lamp Works, Inc., Jan. 7, 1942, (I) Dec. 11, 1945, No. 2,390,502.

Expiring Patents

A new publication service presenting typical claims and one drawing of all individual patents that are expiring and about to become public domain has been started by Scientific Development Corp., 614 W. 49th St., New York 19, N. Y. Each weekly issue will be completely indexed for quick reference to any specific field.

Illinois Expands

The Illinois Condenser Co. moved into a new plant, recently built, at 1616 No. Throop St., Chicago 22, last month. Expanded facilities will enable the company to increase production.



G-E Mycalex—for safe-conduct through shock and heat

● Here is the end of a sealed tubular resistor unit that operates at extremely high temperatures. It forms the outside electrical connection of the unit.

Heat-resistant material designed to withstand impact had to be molded over a long threaded metal insert . . . to intricate dimensions so that a metal shell could be spun over it and held tightly in place. These exacting specifications were met by injection-molding G-E mycalex—compound of glass and powdered mica with a unique combination of properties.

Why not investigate the possibility of specifying G-E mycalex for your own electrical components? This material is available to you in standard rods and sheets or molded to your design.

SEND FOR YOUR OWN COPY. A new bulletin on G-E mycalex is just off the press. A helpful design handbook, it contains complete and up-to-date information for solving your high-frequency insulation problems with G-E mycalex—a hard gray-colored, stonelike material with a unique combination of properties. Find out about new grades of G-E mycalex and new G-E mycalex molding techniques which make wider and more economical applications now possible. Fill in the coupon and mail it today.

GENERAL ELECTRIC

CD46-M4

GE MYCALEX

PLASTICS DIVISIONS (T-4), GENERAL ELECTRIC COMPANY
1 Plastics Avenue, Pittsfield, Mass.

Please send me the new G-E mycalex Bulletin.

Name_____

Firm_____

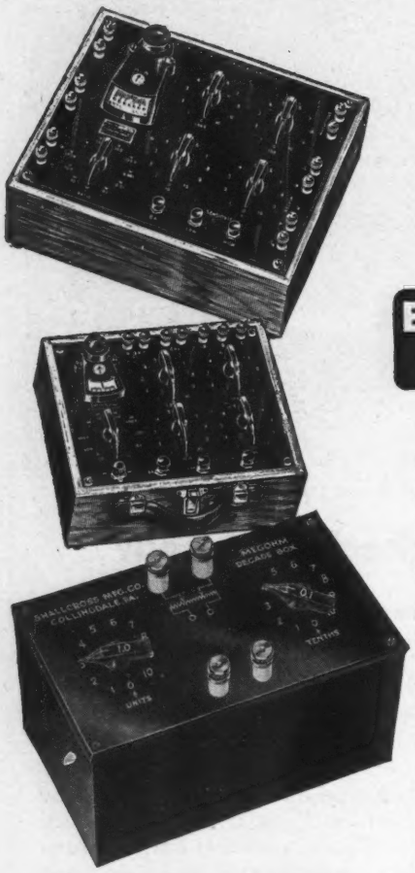
Address_____

City_____ State_____

TYPICAL!

The Shallcross Type 637 Bridge combines both the Kelvin and Wheatstone circuits in a single portable and durable instrument. Provides a resistance measurement range from .001 ohms to 11.10 megohms. List price $100.

YOU DON'T HAVE TO CODDLE SHALLCROSS INSTRUMENTS



LOW PRICED

RUGGED

ACCURATE

EASILY REPAIRED IN CASE OF MISUSE

Shallcross Test Instruments are built for hard, frequent use on any job — for production line, field, school or laboratory service. No need to worry about how or by whom they are used. They're rugged and dependable. In case of misuse, repairs are usually made locally.

These instruments are accurate for every commercial and most laboratory needs. Available in types, sizes and ranges for every testing need — at prices to make their regular use practical.

Write for engineering bulletins on any type.

BRIDGES — RESISTANCE STANDARDS
FAULT LOCATION BRIDGES
DECADE POTENTIOMETERS
HIGH-VOLTAGE TEST EQUIPMENT, etc.

SHALLCROSS MANUFACTURING COMPANY
Dept. EI-56, Jackson & Pusey Aves., Collingdale, Pa.

SHALLCROSS Electrical Measuring Instruments • AKRA-OHM Resistors • Precision Switches • Electronic Engineering

PERSONNEL

D. F. Schmit has been elected a vice-president of the RCA Victor Division, Radio Corporation of America, and henceforth will be in charge of the organization's engineering department. He has held important engineering posts with the company for more than fifteen years. In 1930 he became manager of research and engineering in tube manufacture at the Harrison, N. J., plant, nine years later was named manager of the new products division, and four years later became assistant chief engineer of the RCA Victor Division. Previously he had been connected with the engineering department of the General Electric Co. in Schenectady, and with the E. T. Cunningham Co. in New York.

D. F. Schmit

John S. Kehrer

John S. Kehrer has been named chief production engineer for the Turner Co., Cedar Rapids, Iowa. He was formerly connected with the Modern Steel Equipment Co. as an industrial engineer.

Dr. Joseph F. Libsch has been added to the engineering staff of Lepel High Frequency Laboratories, Inc., New York. He is a consulting metallurgist and a member of the faculty of the Metallurgical Engineering Department at Lehigh University, Bethlehem.

Dr. J. F. Libsch

G. F. Leydorf

G. F. Leydorf has joined the engineering staff of Radio Station WJR, Detroit. Until now he has been a member of the engineering staff of the Crosley Corp., Cincinnati.

Tested for four Years . . . .

Back in 1941 our engineers had completed the design of a new street-lighting control which unfailingly insures adequate illumination regardless of changes and fluctuations in weather and the twilight hour.

Wartime obligations prevented production, but for four years the engineers' prototypes have been tested under actual street-lighting conditions . . . time-proven, it is now offered as our

SUNSWITCH
LIGHT CONTROL

A practical and rugged unit with 100 percent safety factor . . . its sturdy components assure a negligible maintenance cost. Tooling up for large scale production is now completed. Write for Bulletin No. 8239.

The SUNSWITCH can also be used to control illumination of public buildings, outdoor advertising, airport beacons, radio mast running lights, and ships' running lights.

The **RIPLEY** *Company*

28 NEW LITCHFIELD STREET TORRINGTON, CONNECTICUT

Burlington
'DONUT' TRANSFORMERS

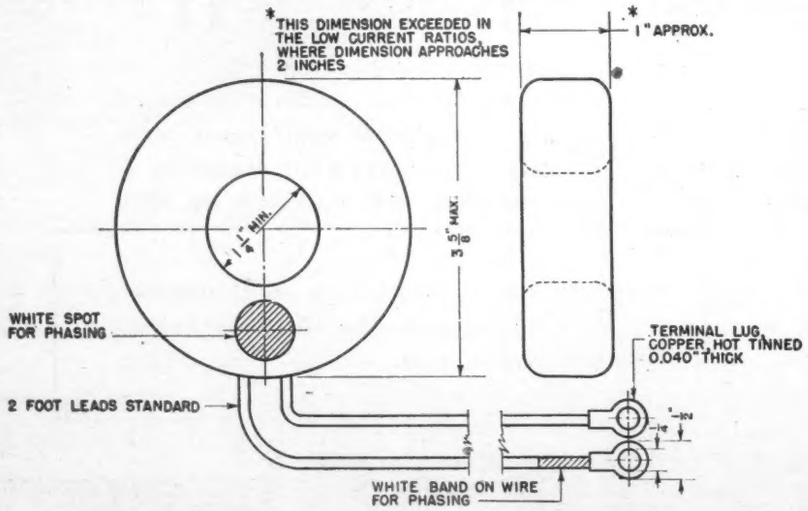
These transformers are designed for use with vane type ammeters which are used on frequencies from 25 to 133 cycles.

Maximum accuracy is obtained at 70% of full scale value and is dependent upon the number of primary turns used. Accuracy is directly proportional to be the number of primary turns.

These transformers are designed for a capacity of two volt-amperes and the secondary windings are of such size as to allow in excess of 800 CM/ampere at maximum rating.

Insulation resistance is such that 4500 volts can be applied without breakdown.

Burlington Bulletin DT gives full information.
Write for a copy today.


* THIS DIMENSION EXCEEDED IN THE LOW CURRENT RATIOS WHERE DIMENSION APPROACHES 2 INCHES
* 1" APPROX.
1 1/8" MIN.
3 5/16" MAX.
WHITE SPOT FOR PHASING
TERMINAL LUG COPPER, HOT TINNED 0.040" THICK
2 FOOT LEADS STANDARD
WHITE BAND ON WIRE FOR PHASING

BURLINGTON INSTRUMENT COMPANY
1201 FOURTH STREET **BURLINGTON, IOWA**

Brig. General Samuel M. Thomas has been made international technical representative of RCA Communications, Inc. He has been director of the Communications Division, Office of Military Government for the United States Army with headquarters in Berlin.

Ben Waxler has joined the Globe Electronics Corp., New York, as chief radio engineer. He was formerly chief radio engineer for the David Bogen Co. and the Regal Electronics Corp.

J. Ernest Smith has joined the engineering staff of Raytheon Mfg. Co. and will head its microwave communication engineering department. During the past twelve years he has been connected with the Radio Corp. of America as research division head of RCA laboratories.

J. Ernest Smith

C. L. Wilson

Carroll L. Wilson has been elected as vice-president of the National Research Corp., Boston. Since 1942 he has been executive assistant to Dr. Vannevar Bush, Director of the Office of Scientific Research and Development.

Louis G. Bacher has been appointed Western District Manager for the General Instrument Corp. and will have charge of the company's Chicago office. He has seen former service with Bendix, Philco and General Electric.

Robert L. Wolff has been appointed chief radio and electronics engineer for Centralab Division of Globe-Union, Inc., Milwaukee, and **Rolland R. Roup** has been made chief ceramic engineer of the organization. Wolff was formerly connected with Western Electric and Wells-Gardner; Roup was formerly with the A. O. Smith Corp. in Milwaukee.

Frank B. Powers has left the Westinghouse Electric International Co., where he was overseas traction manager, to become vice-president in charge of operations and engi-

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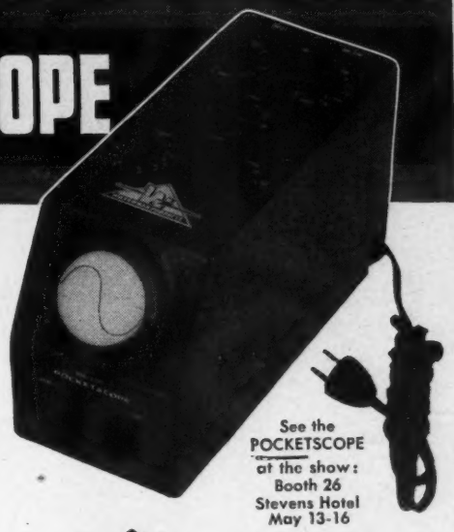

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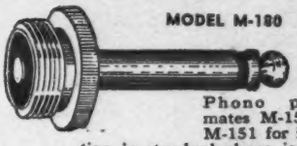

MODEL M-180
Phono plug, mates M-150 or M-151 for insertion in standard phono jack.

MODEL M-192
Solid silver plated double female with coupling nuts.

MODEL M-190
Solid silver-plated double male, mates M-151 or M-150.

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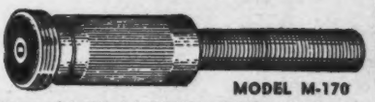

MODEL M-170
Mates with Model M-151 and M-150 Standard solder contacts.

MODEL M-160
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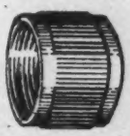
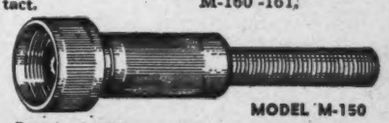


MODEL M-191
Double female coupling mates M-170, M-160 -161.



MODEL M-150
Standard solder contact mates with models M-170, M-161, M-160.

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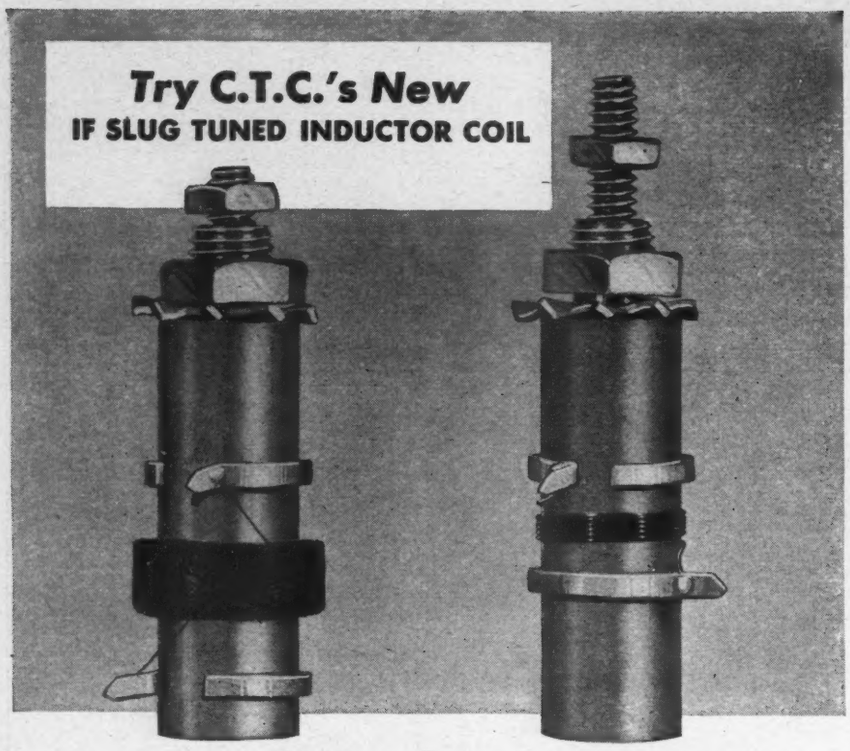

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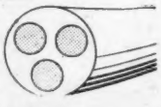

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neering for the Great American Industries. This organization includes among its subsidiaries Connecticut Telephone and Electric Division.

Adelbert R. Morton has been appointed to the post of chief engineer of its electronics division by the Insuline Corp. of America. Previously he had been connected with the Ansley Radio Corp. as chief engineer, was production manager for the Ford Instrument Co. and factory planning engineer for the Western Electric Co.

F. J. Gaffney, former head of the measurement and test equipment group of the MIT Radiation Laboratory, has been appointed chief engineer of the newly-organized Polytechnic Research and Development Company, Inc., 66 Court Street, Brooklyn, N. Y. He will direct both the research and engineering work of this new consulting organization, which is closely affiliated with the Polytechnic Institute of Brooklyn. Before the war, Gaffney was chief engineer for the Browning Laboratories of Winchester, Mass.

F. J. Gaffney

Dr. F. R. Hensel

Dr. F. R. Hensel has been elected vice president in charge of engineering of P. R. Mallory & Co., Inc., Indianapolis, Ind. He has been chief metallurgical engineer for the Mallory company since 1934 and holds degrees from Mining Academy, Freiberg, Saxony; University of Sheffield, England, and Technische Hochschule, Charlottenburg.

He has presented more than forty scientific and technical papers before various metallurgical and other scientific societies, and has been granted more than 140 patents on alloys and metallurgical processes.

Captain Pierre Boucheron has been appointed general manager of the broadcast division of the Farnsworth Television & Radio Corporation and placed in charge of Station WGL at Fort Wayne, Ind. His duties will entail the management of Farnsworth's Fort Wayne AM station WGL as well as a proposed FM station.

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A Handbook of Dry Plate Rectifier Applications

By G. A. Culbertson. Published by Culco, Box 122, Montrose, California.

This compendium describes the operating details and circuits associated with a number of applications for dry plate rectifiers. It contains 16 pages and is priced at 50c.

Proc. of the Society for Experimental Stress Analysis, Vol. III, No. 1.

Edited by C. Lipson and W. M. Murray, 1945. Published by Addison-Wesley Press, Cambridge, Mass. 160 pages 8½x11. Illustrated. Price $5.

This cloth bound volume is the fifth of the semiannual publications of the Proceedings of this Society, which is concerned with the study of structural stresses and methods for their delineation and analysis. This volume contains twelve articles, including three on strain gage technics. The use of photoelasticity, where plastic scale models are subjected to simulated strains and analyzed in polarized light also is covered. Methods for accurately determining the results of strains have been responsible for many design improvements in many fields, where lighter and stronger parts have resulted by the intelligent use of materials. This organization is devoted to the exchange of information on these subjects.

The Theory of Sound

By Lord Raleigh, published by Dover Publications, New York 1945, in two volumes bound as one: Vol. 1, 480 pages; vol. 2, 504 pages; $4.95.

The first American edition of Raleigh's famous classic on "the Theory of Sound", which combines both volumes in one book is likely to make this work as popular a reference book for American scientists, acoustical engineers and designers as it has long been in England. It is astonishing how this 69 year old treatise, first published in 1877, still retains a place of preeminence in modern acoustical literature, and that in fact most modern texts still use more or less the same approach to the theory of sound as first presented by Lord Raleigh in 1877. The work includes a historical introduction containing a short biographical sketch of Lord

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★ FCC Rules and Engineering Standards Governing FM and TV, with charts, etc.
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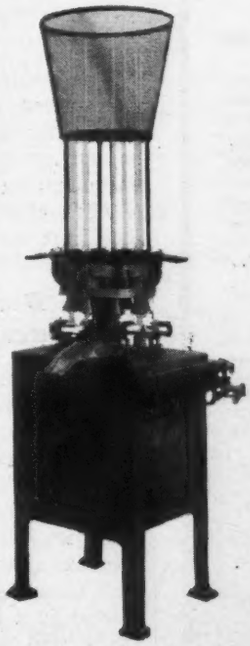

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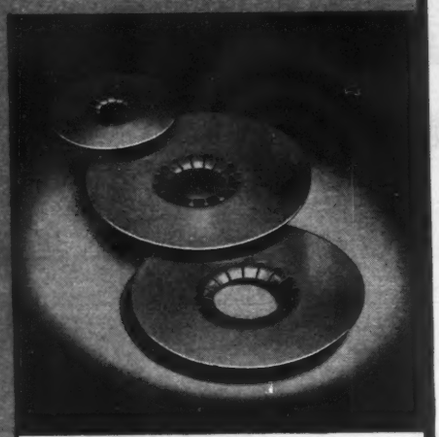

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Raleigh, a summary of the development of acoustics, Raleigh's contributions and a brief bibliography. The text of the two volumes is identical with the second edition published in 1929. The first volume covers essentially the production of sound through the theory of vibrations of dynamical systems, while the second volume is devoted to the propagation of sound presenting the theory of acoustic radiation through fluid media.

Elementary Electric Circuit Theory

By R. H. Frazier, Published 1945 by McGraw-Hill Book Co. 434 pages. Illustrated. Price $4.

This book is written to serve as a text covering elementary electric circuit theory for students of electrical engineering. It is basic, covering all branches of specialization for power, communication and electronics.

Following the description of circuit definitions and basic concepts, chapters appear on resistance networks, alternating current concepts, complex algebra, impedance networks, non-sinusoidal waves, multiphase network, and finally a chapter on transients and their handling.

Radio Pioneers

Edited by Harold P. Westman and collaborators, for the New York Section I.R.E. Published November 1945. Copies $1 from Prof. G. B. Hoadley, Brooklyn Polytechnic Inst., Brooklyn, N. Y.

A souvenir book, giving a historical review of the important advances in the radio art from the beginning up to the early days of broadcasting and the contributions of the early experimenters in this. Excellent for reference use.

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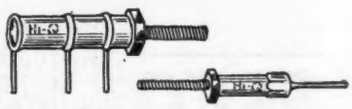

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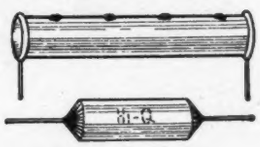

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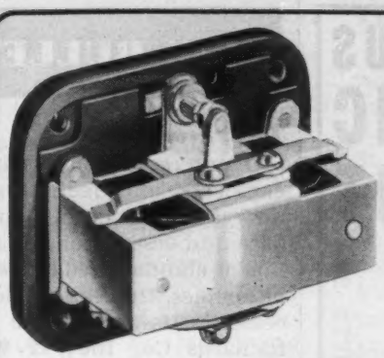

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CO-AX connectors, all types in stock amphenol connectors, from 1 to 25 pins light, heavy duty—write	
500 new rcvrs., BC-603 with manual, semi-compl., less variable cond. and Pwr. unit	4.50
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Telephone WH 4-7658

NEW BULLETINS

Thermocouples

Of interest to purchasing agents, engineers and metallurgists is a new catalog containing engineering data and descriptions of a complete line of standardized industrial thermocouples, their assembles and accessories, issued by the Arklay S. Richards Co., Inc., 72 Winchester St., Newton Highlands 61, Mass. Thermocouples made of chromel alumel and iron constantan and couples made of platinum-rhodium are described. The catalog lists basic parts, wires, insulators and complete assemblies, such as pyrometers.

Welding and Brazing

The Stackpole Carbon Co., St. Marys, Pa., has issued a welding catalog listing carbon rods and plates, paste, welding tips, carbon and graphite, as well as copper coated graphite electrodes. Photographs of these products, engineering data and descriptions are given.

Plastic Compounds

The many uses and industrial applications of Vinylite elastomeric compounds are described and illustrated in a booklet issued by the Bakelite Corp., 30 E. 42 St., New York 17, N. Y. Descriptions of molding compounds, extrusion compounds, flexible sheeting and film and cloth-coating resins are given, with their respective applications. Also included are tables of properties. The applications range from electrical insulation and terminal sleeves to coated army raincoats and taxicab seat upholstering.

Fiberglas Insulation

Electrical insulation materials made of Fiberglas are described in a booklet issued by the Owens-Corning Fiberglas Corp., Toledo 1, Ohio. The properties of this material as well as test data and comparisons with other commercial materials are given and illustrated by graphs. Fiberglas comes in various forms as yarns, tapes, sleevings, cloth and is usually combined with temperature resistant varnishes and impregnants for insulation purposes. High resistance to dampness and abnormal temperatures, high overload capacity and large safety factors are some of the characteristics described.

KURMAN RELAYS

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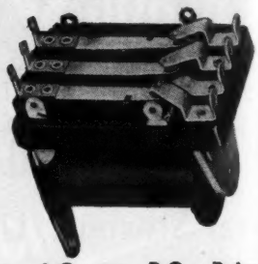
DOUBLE THROW AND TRIPLE THROW



New Type A.C. or D.C. Relay Maintains Adjustment under Stress

Series 16 A.C. & D.C. Relays are specified for aircraft and similar applications where shock and vibration are severe. Main features include:—

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2) **1500-volt dielectric strength between all contacts and ground.**
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For complete details request a copy of Bulletin 1646

Write for details on Kurman line of Relays and Microphone Hummers

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Switch Equipment

A 36-page catalog for engineers containing information on selector type, tone, lever action, medium duty power and special switches, has been published by Centralab, Div. of Globe Union Inc., 900 E. Keefe Ave., Milwaukee 1, Wis. The section on selector switches describes the F, H, and G type indexes including detachable shafts, interstage shields, mounting straps, clips and contacts. Descriptions, construction and specifications are given in the tone switch section for a number of types and acessories. Another section describes bakelite and ceramic types of lever action switches.

Hermetic Sealing

"Stratopax" is the trade name applied to a special process of hermetically sealing electronic components in a neutral gas environment for freedom from moisture, dust, corrosion and weathering conditions, which has been developed by Cook Electric Co., Chicago, Ill. Relays, solenoids, contactors, etc., may be packed in sealed metal enclosures for maximum life of the components. The process is especially important for explosion-proof protection and elimination of fire hazards, when operating under low pressures conditions of high altitude. An engineering report describes the most important functions and gives specifications and illustrations for this packing process.

Vibration Control

The Vibration Div., MB Mfg. Co., New Haven 11, Conn., is distributing an engineering booklet explaining vibration problems and their solution by means of special mounts. Applications of "Isomode" mounts for various conditions are shown and a selector chart facilitates the choice of units for each application. The last part of the catalog describes a variety of products such as vibration exciters, vibration pickups and meters, switching units, preamplifiers and a vibration test machine.

Resistance Control

A wide variety of resistors and controls are described in catalog No. 46 distributed by Clarostat Mfg. Co., 285-7 N. 6th St., Brooklyn, N. Y. Included are attenuators, fixed, slider and power resistors, power rheostats, ballast resistors, voltage regulators, impedance controls, wire-wound controls and resistance decades. Taper characteristics, switching arrangements, range of available values, dimensional sketches and other characteristics are included with the photographs and descriptions of each product.

UHF Thermocouple

A 4-page folder describing uhf vacuum thermocouples is being distributed by the Field Electrical Instrument Co., 109 E. 184th Street, New York. Electrical data construction, dimensions, response and overload characteristics of unmounted vacuum thermocouples are given.

Temp. Controlled Relays

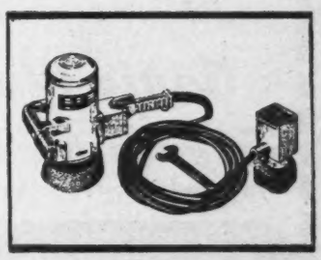
A series of temperature controlled relays is described in a 16-page catalog being distributed by H-B Instrument Co., 2518 N. Broad St., Philadelphia 32, Pa. In the first part of the folder various types of normally open, normally closed and inclosed relays are shown and their load ratings, coil voltages and dimensions are given. The second part illustrates and describes thermo-regulators, mercury plunger relays, multi-contact thermo-regulators, relays and selector switches, thermometers, thermostats and differential temperature controls.

New Portable Grinder Lasts Longer ...Increases Production

The Portable Gaston Grinder is designed for the grinding and sanding of metal—also, with wire brushes, for paint and rust removal. Because it is powered by a 3-phase motor, without brushes, commutators or gears, the Gaston will give long service.

The Gaston Grinder starts at full speed. Its speed remains constant regardless of extra pressure by the operator. This controlled speed under heavy load, eliminates glazing of the grinding wheel; produces a better ground surface.

Three sizes of dust-tight Gaston Grinders are available. Furnished in either "cup-wheel" or "edge-wheel" type, as desired.



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Nomographs for UHF

The second in the series of nomographs for engineers on the design of equipment in the uhf and television ranges, has been issued by the Federal Telephone and Radio Corp., Newark, N. J. The present set numbers 16 nomographs, bringing the total issued to 40. By use of these nomographs laborious computations formerly required for the design of uhf equipment are reduced to a few operations with a straight edge. While the last series contained many design formulas for hf transmissions, 10 of the present nomographs are on the subject of waveguides, including practically every formula that the engineer normally utilizes. Supplementing nomographs previously presented are charts on the shunt peaking method of range extension in wide band amplifiers and on dissipation of power in water cooled devices. Also included are some new subjects, such as two charts on attenuators, one on minimum loss pads and one on paint requirements.

Vacuum Tubes

Eitel-McCollough, Inc., San Bruno, Cal., has published a fully illustrated brochure showing the entire line of Eimac electronic products. Short descriptions and technical data are given with the photographs of each tube type. Many new types of uhf tubes, lighthouse and pulse type tubes, are included. Data also are included on vacuum pump and switches.

Indicator Lights

New indicator light assembly data is published in a reference booklet issued by the Gothard Mfg. Co., 2110 Clear Lake Ave., Springfield, Ill. Scientific and reference data aids the selection of suitable assemblies for any application. The complete line of indicator light assemblies is fully described and illustrated. Built-in resistor assemblies for neon lamps, brackets and accessories also are shown.

High Frequency Cables

High frequency cables using as insulating materials Plastex, Polyethylene, Neoprene, and Buna S are described in a data sheet issued by Simplex Wire & Cable Co., 79 Sidney St., Cambridge 39, Mass. The folder gives, in addition to a description of the physical characteristics of the cables, complete data on electrical characteristics.

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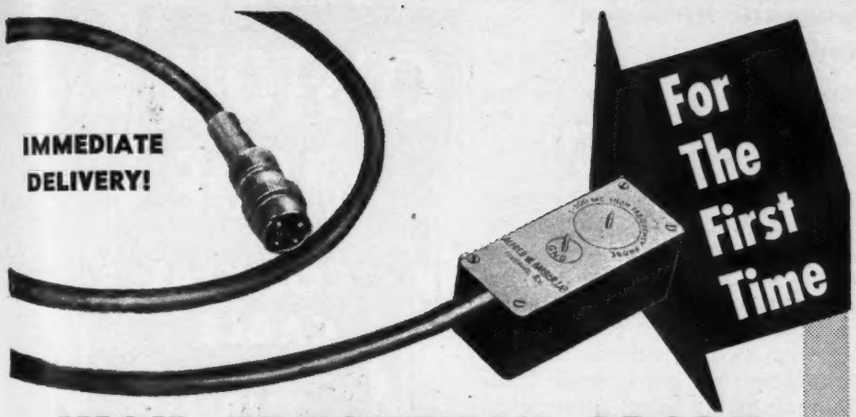

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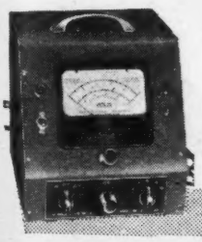

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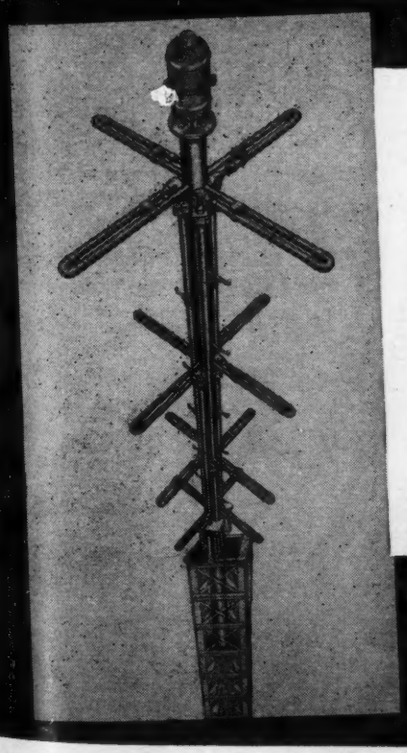

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Latest addition to the famous line of JOHNSON Tube Sockets is the 122-101. A ceramic wafer socket with aluminum base shield and JOHNSON superior contacts—the 122-101 is designed to really "take it"!

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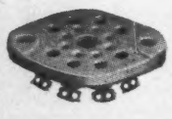
Built-in retainer springs hold tube securely in place under conditions of heavy vibration and shock.

Write for Data Sheet 35 describing the 122-101 or see this socket at your JOHNSON Distributor.



Shown at left are JOHNSON 228 and 275 tube sockets. The 228 socket is ideal for many tubes including the "Tuf-20" and the 275 socket is designed for tubes including the 4-125-A, RK28, 125M, 803 and X404.

JOHNSON Tube Sockets are outstanding and are found widely used in commercial communication and industrial equipment. Write for specific information about sockets to meet your requirements. JOHNSON Tube Sockets, Condensers, Inductors, Insulators, Connectors, etc., for highest quality, adaptability, low cost and rapid delivery.

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CONDENSERS INDUCTORS TUBE SOCKETS INSULATORS ANTENNAS

Automatic Direction Finders

An invaluable aid to aircraft navigation are the automatic radio direction finders described and illustrated in a 28-page booklet distributed by the Sperry Gyroscope Co., Inc., Great Neck, New York. Single and dual direction finding systems are described for homing and position finding applications. The dual equipment provides the pilot with two continuous lines of position bearings on a single indicator permitting quick plotting on a map to obtain true position. Four principal functions are listed for automatic direction finders: 1. Automatic direction finding with sense antenna giving non-ambiguous bearings. 2. Automatic direction finding with anti-static loop for periods of severe rain, dust or snow static. 3. Shielded loop receivers for aural null determination. 4. Use as auxiliary range or broadcast receiver. These four functions and the various components are described in the booklet and complete graphic performance data of the equipment is included.

Vacuum for Industry

A new 24-page booklet entitled "High Vacuum for Industry" is available from the Vacuum Engineering Division of National Research Corp., 100 Brookline Ave., Boston, Mass. High vacuum systems and diffusion pumps, which made possible mass production of Penicillin, magnesium etc., are described and commercial applications with pressures in the range of .000001 to 1 mm. Hg. are shown. The booklet also has descriptions and illustrations of forepumps, condensers, vacuum valves, vacuum gages and controls, and ionization gages. A special section contains useful relations and tables in high vacuum technic.

Cathode Ray Oscillographs

Two folders on cathode ray tubes and cathode ray oscillographs are being distributed by Allen B. Du Mont Laboratories Inc., Passaic, N. J. Eight types of cathode ray tubes for oscillographic and experimental applications are described in one of the folders. They range from 3 in. to 9 in. tubes. Photographs, physical specifications and typical operation data are included. The second folder gives descriptions and specifications for six types of available oscillographs.

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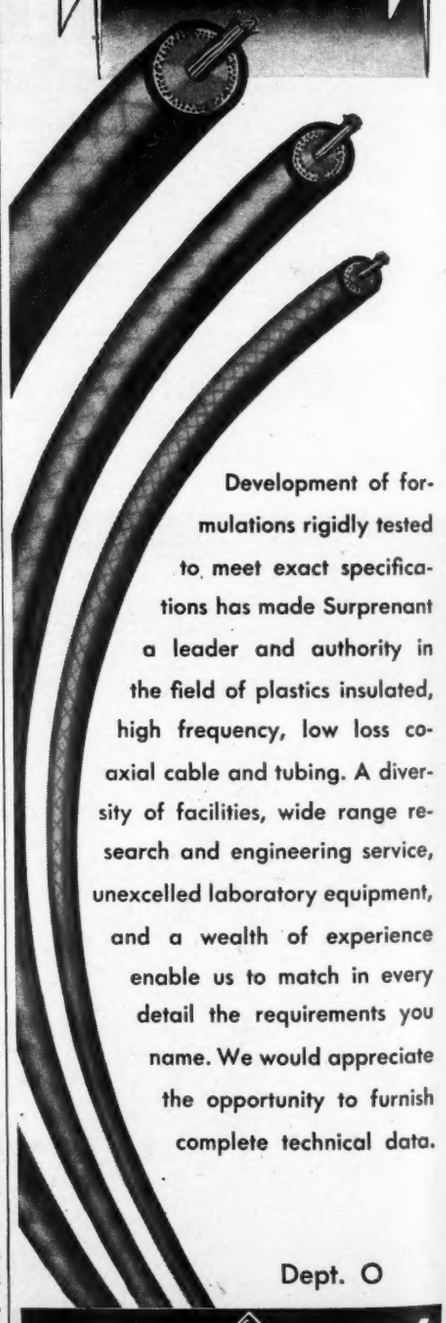

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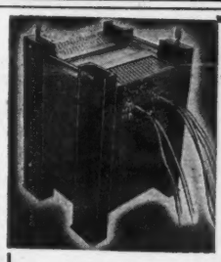

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Quartz Crystals

Standard Piezo Co., Carlisle, Pa., has issued a 16-page catalog describing 18 types of piezo-electric crystals and new developments in crystal processing, such as ammonium-difluoride etching, x-ray analysis and others. With each type crystal, photographs, description, specifications and dimensions are included.

Facsimile Communication

Facsimile duplex communication equipment designed to take the place of the telegraph printer is described in a 4-page folder issued by Finch Telecommunications, Inc., 10 E. 40th St., New York. Faster and more economical than the telegraph printer, the instrument is available for speeds from 15 sq. in. per minute to 48 sq. in. per minute depending on the type of communication channel. Typical uses are described and sample photographs of facsimile transmissions are shown.

Licenses WE

Major Edwin H. Armstrong has granted a license to Western Electric Co. under his FM patents for the manufacture and use of FM apparatus for mobile and certain other communication purposes.

The Bell System is conducting extensive trials of mobile radio telephone service, and Western Electric plans to provide frequency-modulation apparatus for use in that service.

Now It's Musitron

Musitron Co., is the new name of the organization formerly known as the L. M. Sandwick Associates, manufacturers of phonographs and sound equipment. Although there have been extensive changes, the management has not been changed and is still under the direction of Leo Frankel. Headquarters are at 223 West Erie Street, Chicago.

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by VICTOR J. YOUNG

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CHAPTER HEADS

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We maintain complete laboratories and private airport for research and development of aviation, radio, electrical and automotive equipment.

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Alexander Norden, Jr., *President*

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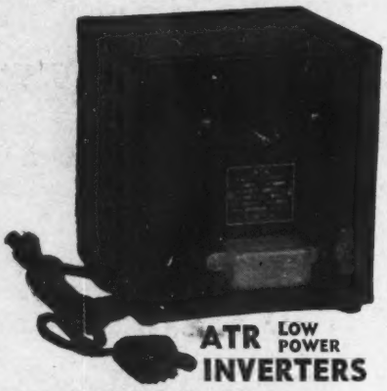

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OPA Effects on AM, FM and TV

The Civilian Production Administration's order curbing new construction to aid the veterans' housing shortage, may not have as serious an effect on broadcasting station construction, particularly FM and television, as was first feared.

The Federal Communications Commission does not feel that the wartime "freeze" mandate will be reinvoked. And as for duration, best guess (based on the E. I. reporter's talks with CPA and FCC officials) is that the CPA restrictions on new building structures for broadcasting stations will not last beyond 1946. Perhaps the situation may clear up by the coming Fall.

The CPA order affects only buildings—the structures and the integral components of buildings, such as plumbing and heating fixtures, although it may also hit air-conditioning units. But radio equipment—transmitters, studio apparatus, antenna towers, power generating equipment, transformers, testing equipment, conveyors (and even elevators)—are completely exempted, CPA sources state. The radio-station equipment, they emphasize, is not considered a part of the physical building structure.

Low-band FM?

As to the possibility of the FCC restoring low-band FM transmission, owing to impending delays in construction of high-band FM stations, there seems nothing like this in the wind; FCC sources express their viewpoint that such a step would not be necessary unless the CPA materials' ban were extended to include station radio apparatus—which is most unlikely.

Opinion around Washington is that since the FCC has definitely determined upon the upper-band FM allocation, a two-band plan would slow up the manufacturers' future output of home receivers containing FM circuits.

Television, under the CPA ruling, will undoubtedly be slowed up or actually stalled more than any other broadcasting service, because television needs new specialized construction for its studios and transmitter buildings in the cities where it is not now located. The hiatus due to the construction ban probably is determined by the FCC because it will give more time to study black-and-white versus color video.

In the final analysis, manufacturers can go ahead with their produc-

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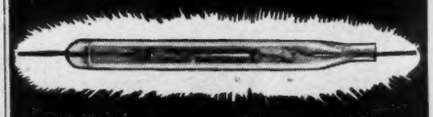

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tion of transmitters and receivers because, after all, television is not due to get away for any major head start as a public service until the fall or close of 1946. In the areas where stations are already on the air, home television receivers can be sold without restriction.

The most important thing in this CPA picture therefore is that AM-FM television equipment will not be blocked. Thus new stations may find temporary locations in existing buildings for their studios. Transmitters could be housed in old buildings or modified structures, using the $1,000 exemption expenditures.

Studio and transmitter buildings will be considered separately, it is indicated by the CPA officials. Thus construction or repair funds up to $1,000 can be spent on each without CPA approval.

•

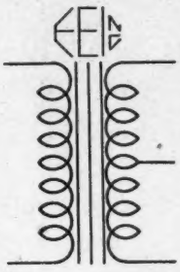
Local decisions control

Also CPA sources indicate that individual decisions as to new construction of local buildings will be entirely dependent upon the 71 regional directors and the local committees for the Federal Housing Administration—a fact which presents "silver linings" for the broadcasting industry. Thus there will be areas where there is no housing shortage for veterans—this is especially true in the smaller cities and towns where FM stations are planned—just as during the wartime "freeze" there were communities with no broadcasting stations where radio listening service can be deemed essential. In these instances—and this should be helpful to FM and new AM stations—the local housing committees (consisting of representatives of the local government, builders and the FHA and CPA field officials) will be amenable to granting approval to radio broadcasters with proof of essentiality of their station buildings' programs.

Thus the picture, as of the present, is not too black, but has many loopholes of hope.

Radio Manufacture Will Top 22,000,000

Radio manufacturers will produce 22,000,000 receivers during 1946. The figure is based on the results of a questionnaire sent to all manufacturers by FCC and represents expected production of 85 manufacturers. The expected total is greater than the largest previous year's production, which was 13,000,000 in



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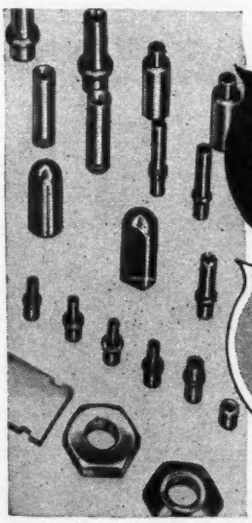

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1941. Of the twenty-two million sets to be produced, FM will account for approximately 1,800,000 sets. Tabulated figures follow:

Type of receiver	Manufacturers reporting production plans†	Production	Per Cent
AM band only	76	16,736,862	79.2
FM band only (88-108 Mc)	8	86,286	.4
AM band, FM band (88-108 Mc)	41	1,689,750	8.0
Television band only (Channels 1-13 incl.)	13	44,706	.2
AM band, FM band (88-108 Mc) Television band (Channels 1-13 incl.)	14	54,606	.3
Other			
AM band, Television band (Channels 1-13 incl.)	1	500	*
FM band, Television band (Channels 1-13 incl.)	1	500	*
Television (Channels 1-6 incl.)	1	4,000	*
AM band, Television band (Channels 1-6 incl.)	1	10,000	*
Miscellaneous	5	21,250	.1
Receiver Type Unspecified	7	2,481,300	11.7
Total Production of Receivers	85	21,129,760	100.0
FM adaptors	4	47,000	
FM converters	3	37,000	
Other	1	1,000	
Total		85,000	
Units supplied to others	2	90,000	
Units for export	16	677,050	
Total for all receiver types		21,981,,810	

*Less than one-tenth of 1%.

†The same manufacturer may be reported on more than one line.

Horni Reorganizes . .

Horni Signal Mfg. Corp., New York, has been reorganized and all operations have been concentrated in a newly acquired location at 421 West 54th Street, New York. The company manufactures selenium rectifiers, traffic control equipment, fire alarm systems, etc. Various locations formerly occupied by the company in New York and Newark, N. J., have been vacated.

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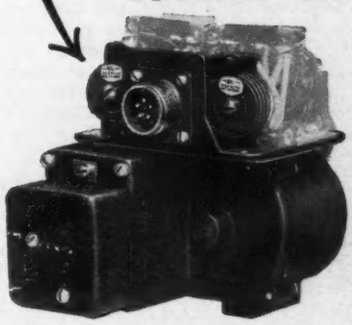

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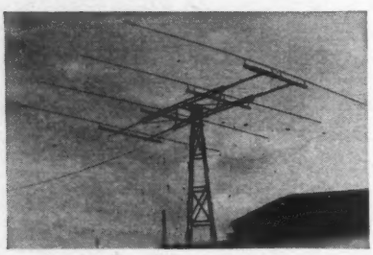

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Function of Ion-Trap In Cathode-Ray Tubes

Since the specifications of certain cathode-ray tubes mention an ion trap, the question arises: What is an ion trap and what does it do? The answer is now forthcoming from the engineers of Allen B. DuMont Laboratories.

"It will be recalled that certain prewar television cathode-ray tubes acquired large brown areas on their screens. These areas were caused by ion bombardment of the screens and were particularly prevalent in tubes employing electrostatic focus and magnetic deflection. The reason was that the cathode of any tube emits electrons and, unfortunately, also a small amount of ions. The ions are very much heavier than the electrons.

"In all electrostatic tubes the ions are deflected equally with the electrons, and thus there is no evidence of ion burns. In magnetic deflection tubes, however, the ions are not materially deflected with the electron beam. This permits the ions to hit the screen in a relatively small area at the center of the screen, with a resulting disintegration of the center area. This trouble is very serious in tubes having magnetic deflection and electrostatic focus since the ions are concentrated by the focus anode and beamed at the center of the tube in a small area at all times when the tube is in operation. With all-magnetic tubes the trouble is considerably less since ions are more widely dispersed.

"In order to eliminate burning of screens, an ion-trap gun has been developed and is used in certain DuMont tubes such as Type 10BP4. The ion trap functions by separating the ions from the electrons by means of combined electric and magnetic fields. Then, by means of an additional magnetic field, the electron beam is coaxially aligned in the gun so as to be centered in the focusing and deflecting systems as well as up on the screen. The magnetic fields used in this application are furnished by a small coil and lamination assembly that is placed over the neck of the tube behind the focus coil.

"In the case of the larger tubes—15-inch diameter and over—it has not been necessary to incorporate this ion trap since the dispersion of the ions is such that no ion disinegration of the screen is in evidence at the comparatively high (10-15kv) accelerating voltage normally used throughout the life of such tubes."

ELECTRONIC INDUSTRIES

Advertisers, May 1946

	Page
Adams-Westlake Co.	99
Advance Research Corporation	126
Aerovox Corporation	28
Alden Products Co.	138
Allied Radio Corp.	150
Alpha Metals Inc.	152
American Electrical Heater Co.	154
American Lava Co.	115
American Phenolic Corp.	27
American Television & Radio Co.	172
American Time Products Inc.	10
American Transformer Co.	35
Amperex Electronic Corp.	2
Amperite	150
Andrew Co.	116
Arnold Engineering Co.	134
Astatic Corporation	57
Atomic Instrument Co.	97
Audio Development Co.	156
Aviometer Corp.	176
Ballantine Laboratories Inc.	128
Barber Laboratories, Alfred W.	167
Barber-Colman Co.	161
Barker & Williamson	124
Bell Telephone Laboratories	139
Benwood-Linze Co.	177
Bird & Co., Richard H.	180
Bliley Electric Co.	155
Bogen Co., Inc., David	146
Boonton Radio Corp.	158
Brainin Co., C. S.	173
Burke Electric Co.	175
Burlington Instrument Co.	148
Burndy Engineering Co., Inc.	49
Burstein-Applebee Co.	173
Caldwell-Clements, Inc.	161, 175
Cambridge Thermionic Corp.	152
Cardwell Mfg. Corp., Allen D.	120
Centralab	43
Chicago Transformer Div. of Essex Wire Corp.	140
Clarostat Mfg. Co., Inc.	157
Coleman, Martin	173
Collins Radio Co.	39
Communications Equipment Co.	162
Concord Radio Corp.	19
Cornell-Dubilier Electric Corp.	51
Cornish Wire Co., Inc.	180
Crystal Research Laboratories, Inc.	146
Dalis, Inc., H. L.	178
Daven Co.	Cover 3
DeJur-Amsco Corp.	6
DeMornay-Budd, Inc.	145
Diamond Instrument Co.	33
Distillation Products, Inc.	111
Dolph Co., John C.	56
Drake Electric Works	180
Drake Manufacturing Co.	150
Driver-Harris Co.	109
Dumont Electric Co.	133
DuMont Laboratories, Inc., Allen B.	41, 119
Eastman Kodak Co.	153
Eby, Inc., Hugh H.	16
Eisler Engineering Co., Chas.	169
Eitel-McCullough, Inc.	42
Electric Specialty Co.	159
Electrical Equipment, Inc.	174
Electrical Reactance Corp.	160
Electro Products Laboratories	157
Electro Tech Equipment Co.	174
Electronic Apparatus, Inc.	159
Electronic Engineering Co., Inc.	146
Electrons, Inc.	138
Engineering Co.	174
Erie Resistor Corp.	25
Farnsworth Television & Radio Corp.	137
Federal Screw Products, Inc.	174
Federal Telephone & Radio Corp.	11, 123
Ferris Instrument Co.	117
Formica Insulation Co.	103
Freed Radio Company	161
General Cable Corp.	12, 13
General Cement Mfg. Co.	173
General Electric Co.	5, 58, 59, 121, 143, 163
General Industries Co.	124
General Plate Div., Metals & Controls Corp.	38
Getz Bros. & Co.	169
Goat Metal Stampings, Inc.	170
Gramer Co.	163
Graphite Metallizing Corp.	154
Guardian Electric Mfg. Co.	101
Guthman & Co., Inc., Edwin I.	130
Hammarlund Mfg. Co., Inc.	D-2
Hastings Sales Engineering Co.	177
Heinemann Circuit Breaker Co.	45
Helipot Corp.	125
Hermatic Seal Products Co.	129
Heyman Mfg. Co.	166
Hopp Press, Inc.	166
Indiana Steel Products Co.	46
Industrial Timer Corp.	154
Industrial Transformer Corp.	44
Instrument Glass & Mirror Co.	169
Instrument Resistors Co.	151
Insuline Corporation of America	118
International Machine Works	159
International Nickel Co., Inc.	22
Interstate Manufacturing Corp.	171
Intex Company	164
Jackson Electrical Instrument Co.	4
Jefferson Electric Co.	105
Jennings Radio Manufacturing Co.	18
Jensen Radio Manufacturing Co.	14
Johnson Co., E. F.	168
Jones Division, Howard B., Cinch Mfg. Corp.	161
Kahle Engineering Co.	177
Karp Metal Products Co.	15
Keuffel & Esser Co.	135
Kings Electronics Co.	151
Kurman Electric Co.	162
Langevin Co., Inc.	127
Lapp Insulator Co.	40
Lavoie Laboratories	107
Lord Manufacturing Co.	47
Macallen Company	114
Makepeace Co., D. E.	24
Mallory & Co., Inc., P. R.	Cover 2
Marion Electrical Instrument Co.	122
Measurements Corp.	132
Merit Coil & Transformer Corp.	171
Millen Mfg. Co., Inc., James	160
National Company, Inc.	50
National Gasket & Washer Mfg. Co.	177
National Vulcanized Fibre Co.	29
Newark Electric Co.	169
Ohmite Mfg. Co.	3
O'Neil-Irwin Mfg. Co.	163
Patton-MacGuyer Co.	173
Permoflux Corp.	136
Plasticraft Products Co.	162
Potter Instrument Co.	37
Premax Products Div., Chisholm Ryder Co., Inc.	178
Radex Corp.	180
Radio Corporation of America	Cover 4
Radio Wire Televison, Inc.	166
Rauland Corp.	36
Revere Copper & Brass, Inc.	7
Rice's Sons, Bernard	23
Rider Publisher, Inc., John F.	171
Ripley Co.	147
Seeburg Corp., J. P.	32
Segel Co., Henry P.	175
Shallcross Mfg. Co.	144
Shevers, Inc., Harold	164
Sigma Instruments, Inc.	179
Simpson Electric Co.	52, 53
Solar Mfg. Co.	60
Speer Carbon Co.	26
Sperry Gyroscope Co., Inc.	17
Sprague Electric Co.	149
Stackpole Carbon Co.	48
Struthers-Dunn, Inc.	141
Stupakoff Ceramic & Mfg. Co.	20, 21
Sun Radio & Electronic Co., Inc.	126
Superior Electric Co.	34
Surprenant Electrical Insulation Co.	168
Sylvania Electric Products, Inc.	8, 9
TAB	164
Television Digest & FM	159
Triplett Electrical Instrument Co.	54, 55
Tung-Sol Lamp Works, Inc.	30
Turner Co.	31
University Loudspeaker, Inc.	178
Vangtronic Corp.	167
Victoreen Instrument Co.	172
Vokar Corp.	170
Walker-Jimieson, Inc.	113
Waterman Products Co.	151
Wellons, Richard	173
Western Electric Co.	131
Weston Electrical Instrument Corp.	142
Wincharger Corp.	167
Wrigley Co., Wm.	165
Zenith Optical Laboratory	157
Zophar Mills, Inc.	164

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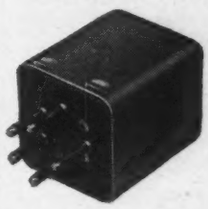
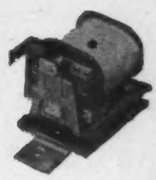
- Beryllium copper armature and contact springs.
- Spring, reed-type, armature hinge with low reluctance gap.
- High permeability, low-residual iron parts



41 R(dc), RZ(ac)



41 FZ(ac), F(dc)

Size:

Unenclosed types: 1" x 1 7/32" x 2 3/16" *

Plug-in types: 1½" x 1½" x 1⅞" high.

*(Long dimension includes full length of mounting bracket).

Minimum Input Requirements:

20 milliwatts for D.C. types.
0.1 volt-amperes for A.C. types.

Contacts:
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Ratings up to 15 amperes with low voltage D.C. or up to 1 K.W. incandescent lamp load at 115 volts A.C., with sufficient input power.

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Federal Starts Duplex Tower

Ground has been broken for the erection of the 300-foot microwave tower which will be an important part of Federal Telecommunication Laboratories at Nutley, N. J., which are operated by I.T.&T. and its subsidiary companies. In connection with the ceremonies some idea of the extensive use to which a tower of the kind may be put was outlined by Colonel Sosthenes Behn, I.T.&T. president.

The present plan is to use the tower for FM broadcasting, Pulse Time Modulation broadcasting, television in color and black and white, police radio networks, communication with mobile units, radar applications, aerial navigation and the interception of illegal transmissions.

It is pointed out that in a single tower there might be simultaneous operation involving 12 FM programs, 6 color television programs, 4 black and white television programs, 6 police networks for various districts, including multiple transmission to delivery trucks, trains, etc., as well as microwave transmission of long distance telephony and television.

Sylvania Tubes Made in England

Sylvania type radio tubes will be manufactured in Great Britain in large quantities by a newly formed company involving interests connected with A. C. Cossor Ltd., London, one of the largest manufacturers of radio and radar equipment in the British Empire. The new company will be known as Electronic Valves, Ltd. It will manufacture radio receiving, cathode ray and other types of electron tubes for British markets.

Biddle Moves

James C. Biddle Co., Philadelphia, henceforth will do business under a single roof at a new location at 1316 Arch Street. The company manufactures insulation teesting instruments and vibrating-reed frequency meters and tachometers.

Locke Expands

The Locke Insulator Corp., Baltimore, has considerably enlarged manufacturing facilities. A new plant affording an additional 30,000 of working space was placed in production operation on May 1.

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